PORTABLE GASOLINE ENGINE DRIVEN CENTRIFUGAL FIRE PUMP

JOHNSON MODEL P-500

★

Operating Instructions and Maintenance Manual

Manufactured by

JOHNSON MOTORS

WAUKEGAN, ILLINOIS, U.S.A.

for BUREAU OF SHIPS • U.S. NAVY

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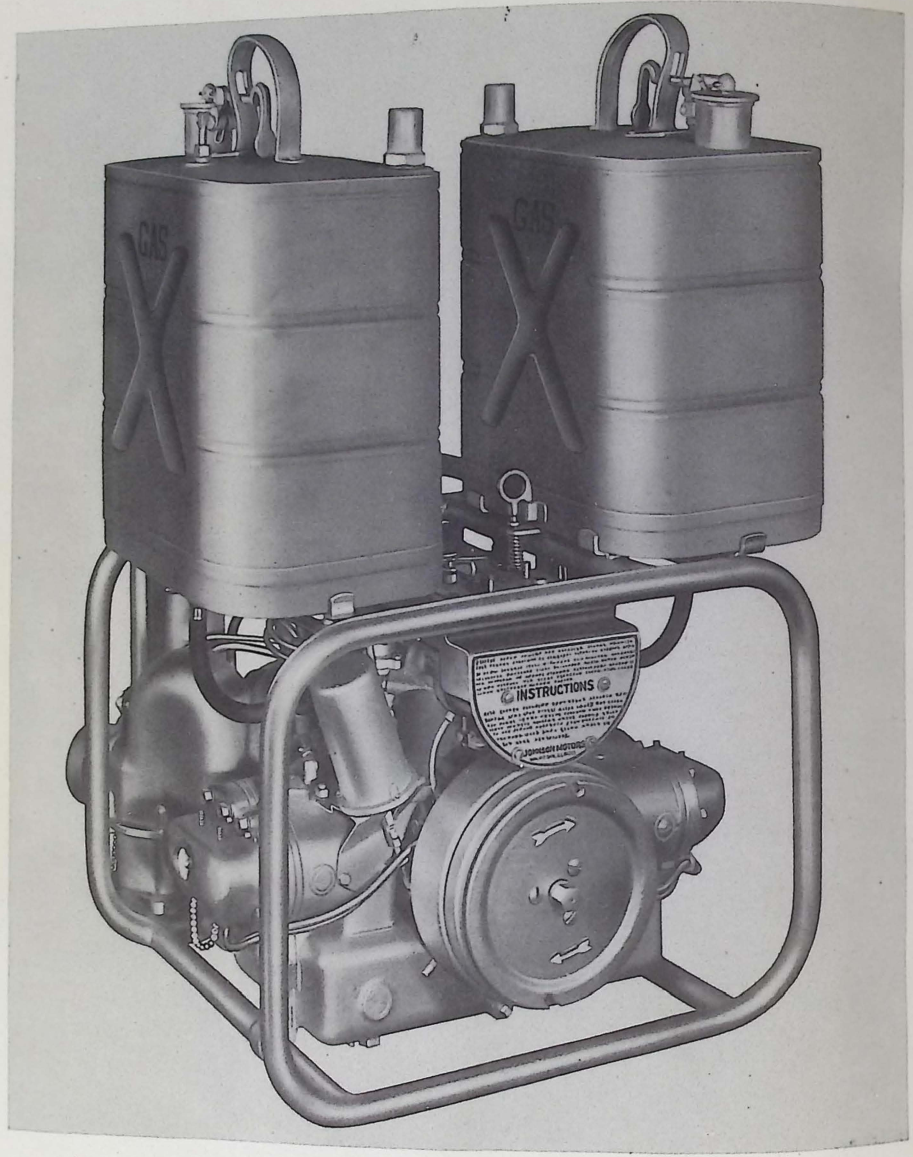

Johnson Model P-500 Pump

Preface

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The JOHNSON MODEL P-500 PUMP is a portable, compact, high output, gasoline engine driven water pump designed for and used by the United States Navy for fire fighting and salvage where other types of pumping equipment are not available or are inadequate.

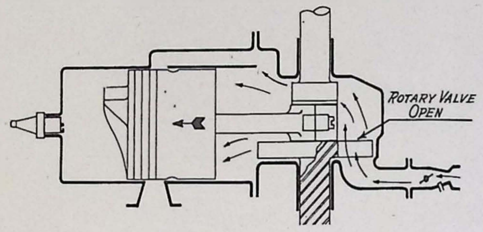
This MANUAL has been prepared in cooperation with the Navy to acquaint those who will use the pump with (a) the theory of operation, (b) the complete unit and its component parts, (c) preparation of the unit and accessories for operation, (d) starting and operating the unit, (e) diagnosing and correcting misadjustments and troubles, (f) maintenance and repair, and (g) parts lists and prices. It is designed to also serve as a text-book in the instruction of personnel.

The first few seconds and minutes of a fire are critical. If it is not controlled quickly it may never be—or control may be many times more difficult and costly.

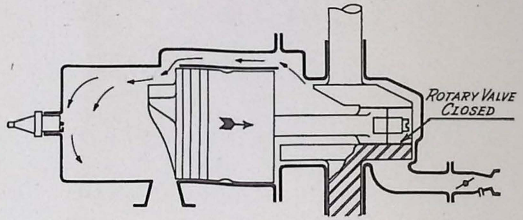
Fire fighters must know their equipment thoroughly in advance of the emergency. That is the purpose of this Manual; it will be of little use after a fire starts.

THE TWO-CYCLE GASOLINE ENGINE

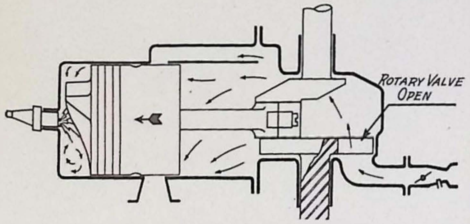
The Two (stroke) Cycle Gasoline Engine (used as the power source in the Model P-500 Pump) is quite different from the four cycle type used in automobiles, trucks, tractors. It has no timing gears, camshaft, valves. In each cylinder it fires once every revolution (two strokes of the piston). The lower end of the piston draws the fresh charge of fuel and air into the crankcase and there compresses it; the upper end of the piston compresses the charge in the cylinder and receives the force of the burning (explosion) after it is ignited. The sequence of these operations is illustrated below. Note captions.


ROTARY VALVE OPEN

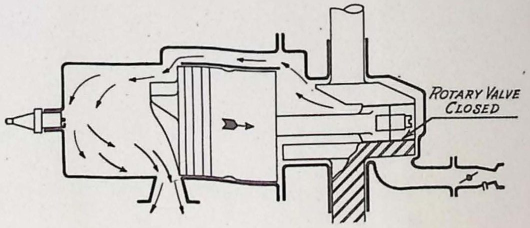
"A" Intake of Fuel and Air to Crankcase


ROTARY VALVE CLOSED

"B" Fresh Charge Transferring from Crankcase to Cylinder


ROTARY VALVE OPEN

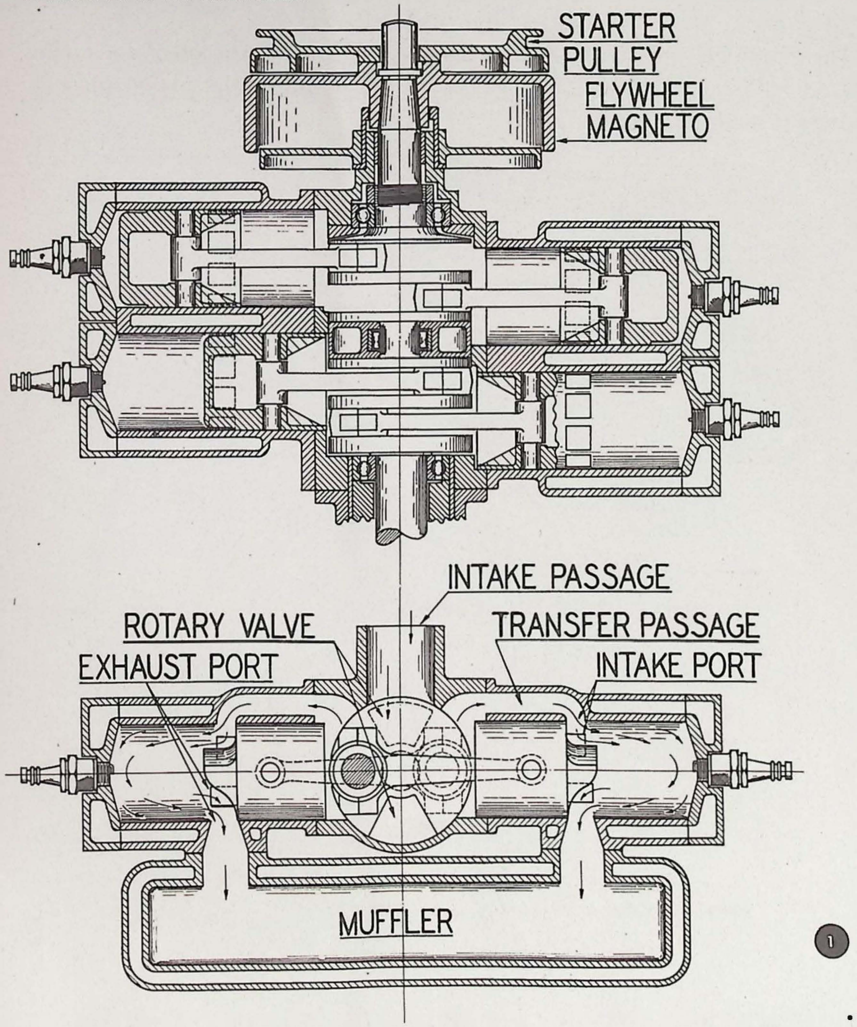
"C" Completion of Compression, Beginning of Combustion in Cylinder


ROTARY VALVE CLOSED

"D" Exhaust from Cylinder and Transfer of New Charge from Crankcase to Cylinder

THE FOUR-CYLINDER TWO-CYCLE GASOLINE ENGINE

In the four-cylinder, two-cycle engine (used in the Model P-500 Pump) there are four cylinders mounted on two crankcases. Two opposing cylinders—at the fly wheel end—are mounted on a common crankcase; the other two cylinders which are likewise opposed, are mounted on another common crankcase. (For convenience the two crankcases are made in one piece with a partition and bearing between.) The sequence of operation in each of the opposing cylinders in a pair is identical; exhaust, transfer, compression, firing (ignition), in these two occur at the same instant. Likewise in the other pair. But one pair has its operations set one-half revolution (180 degrees) from the other pair. There is thus a two-cylinder impulse twice for each revolution of the crankshaft.

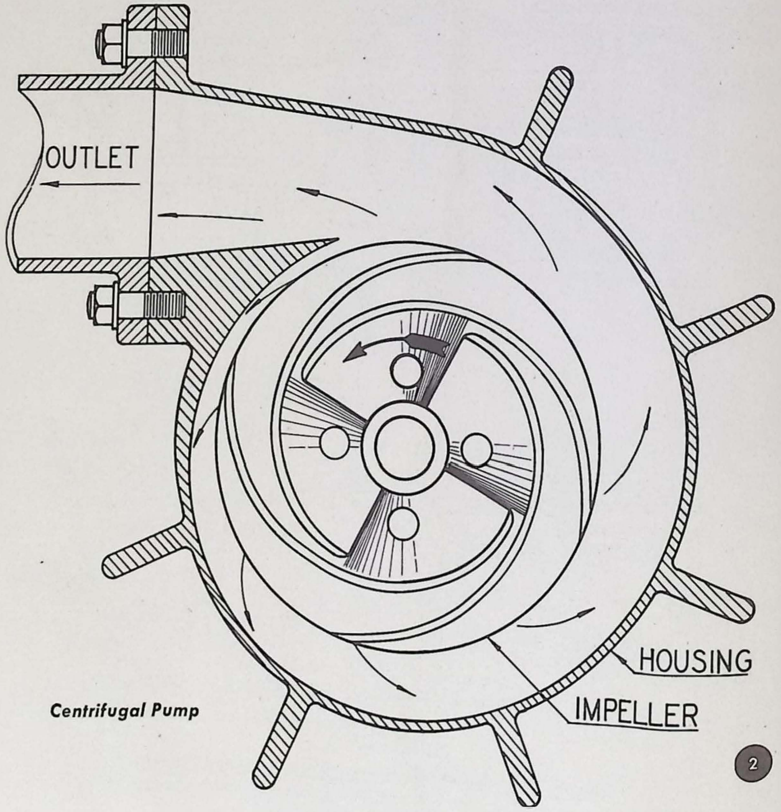

STARTER
PULLEY
FLYWHEEL
MAGNETO
INTAKE PASSAGE
ROTARY VALVE
TRANSFER PASSAGE
EXHAUST PORT
INTAKE PORT
MUFFLER
①

THE CENTRIFUGAL WATER PUMP

A centrifugal water pump (as used in the Model P-500 Pump) consists of a closed housing in which, mounted on a suitable shaft, is an impeller which is rotated at high speed. The impeller blades give the water high velocity in a circular and outward direction. At high velocity, and under high pressure created by this velocity, the water passes out of the pump housing through the discharge opening. Since the water in the housing is thus thrown violently out of it, water from the source, through the suction hose, rushes into the intake opening to take its place.

In the centrifugal pump there are no pump valves, no gears or "rotors," no pistons or cylinders, no vanes, as in other types. Advantages: simplicity, high volume, high efficiency, practically no wear, ability to pump water containing some abrasives (dirt), and light weight. See Fig. 2.

The centrifugal type of pump will not pump air alone. It must be full of water if the "pumping action" is to be accomplished. Filling the pump—and intake hose—with water before starting is called priming.

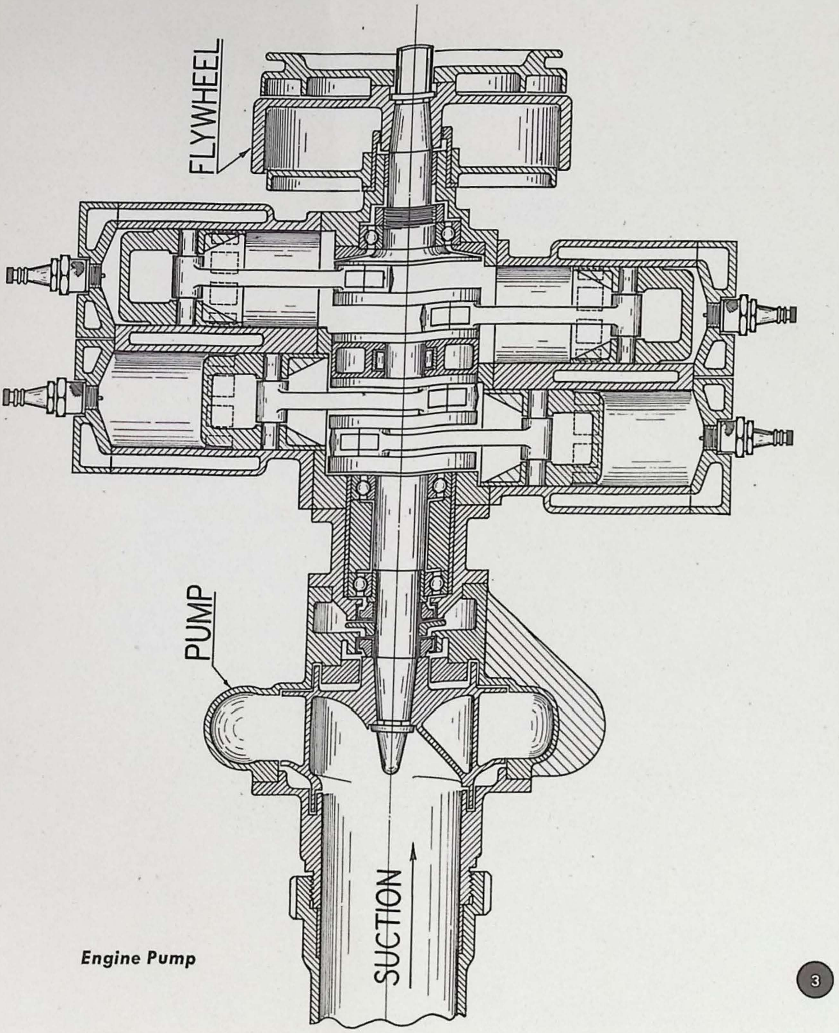


Centrifugal Pump

②

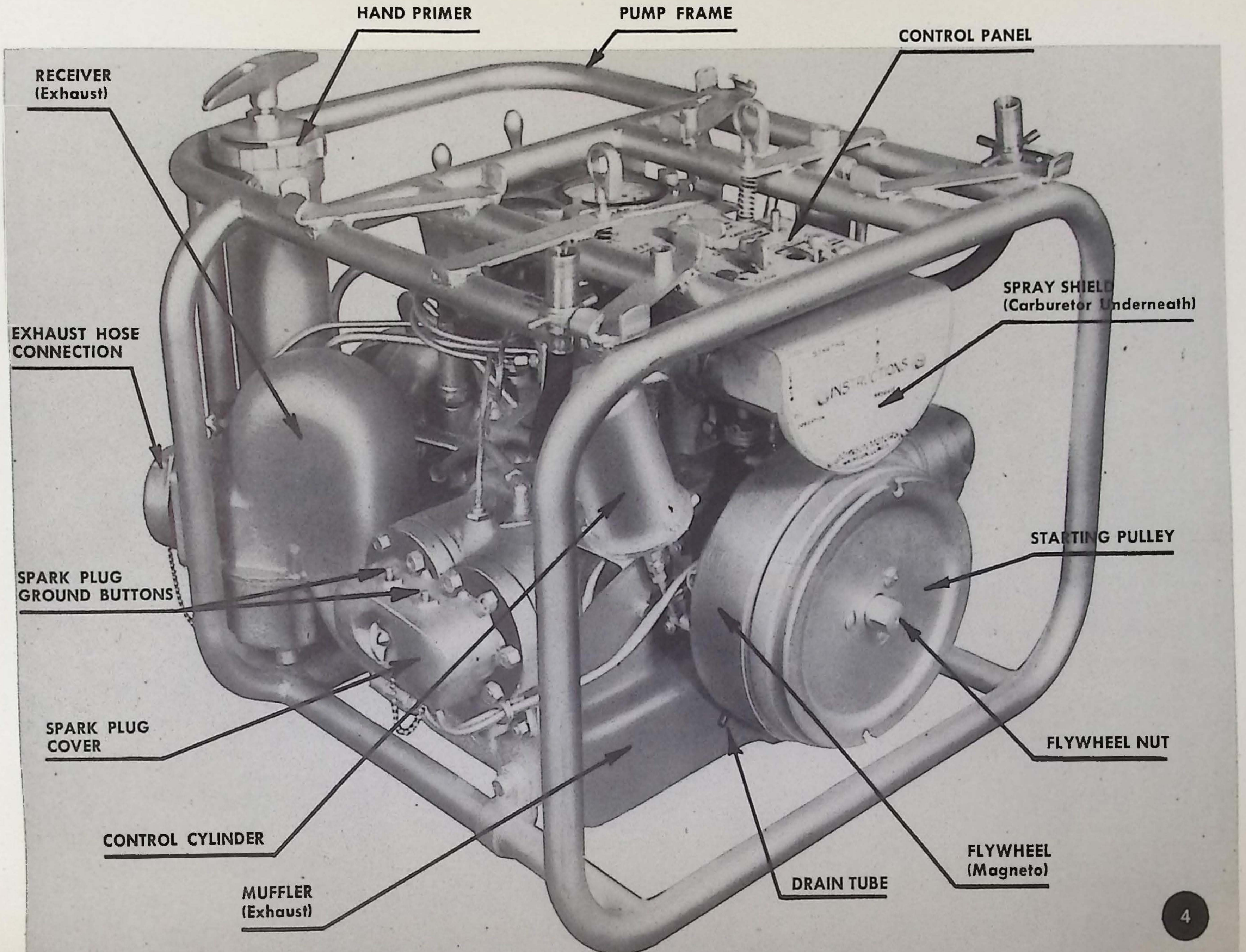
THE COMBINATION OF ENGINE AND PUMP

In the Model P-500 Pump the crankshaft of the engine is extended into the pump housing which is mounted directly onto the engine crankcase—suitable bearings for supporting the shaft being interposed between the two. The pump impeller is then mounted directly on the engine crankshaft. By this very simple and compact arrangement, the pump, which moves the water, and the engine, which furnishes the power, become in effect one unit, eliminating extra weight, extra bearings, couplings. See Fig. 3.



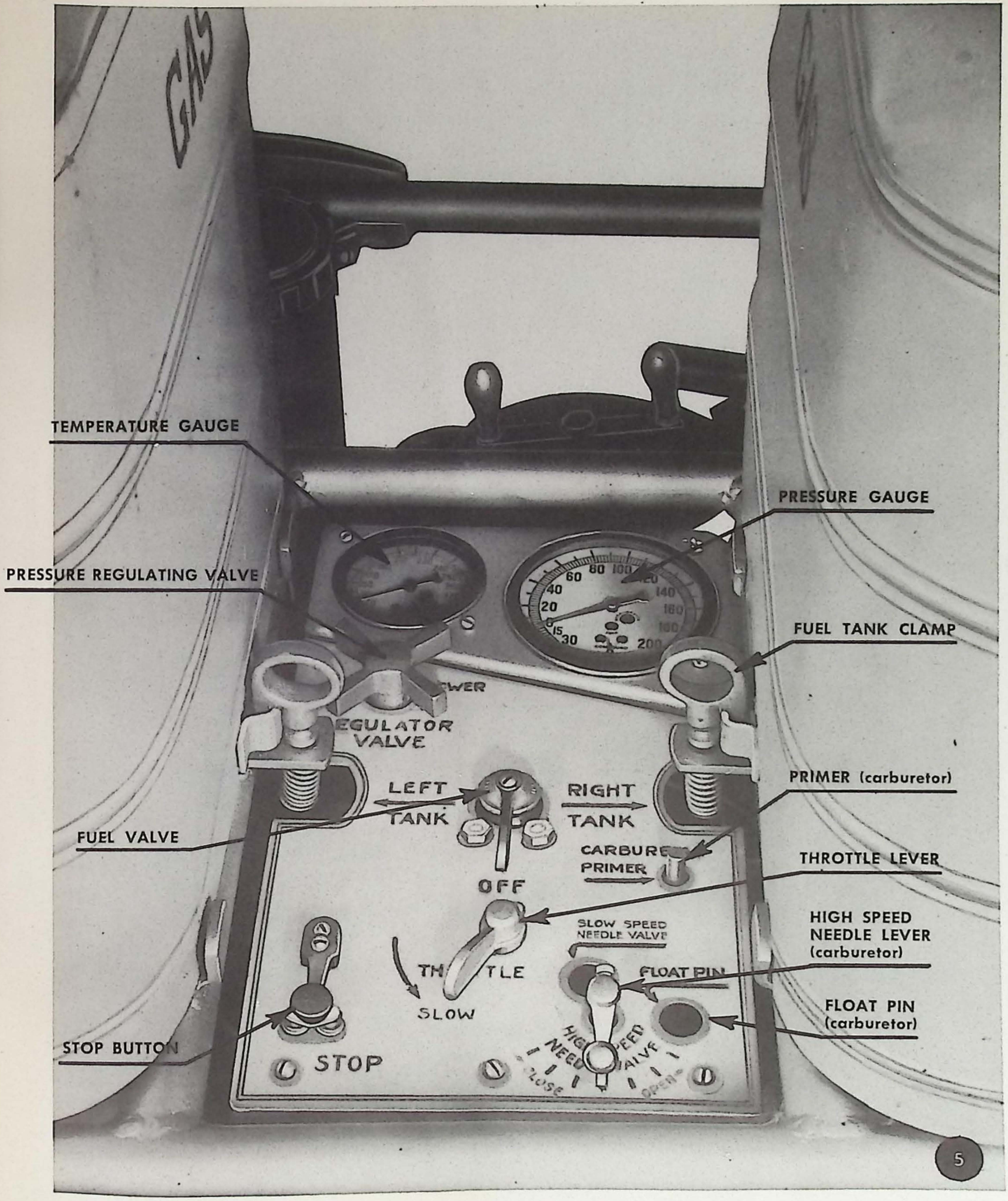
Engine Pump

③

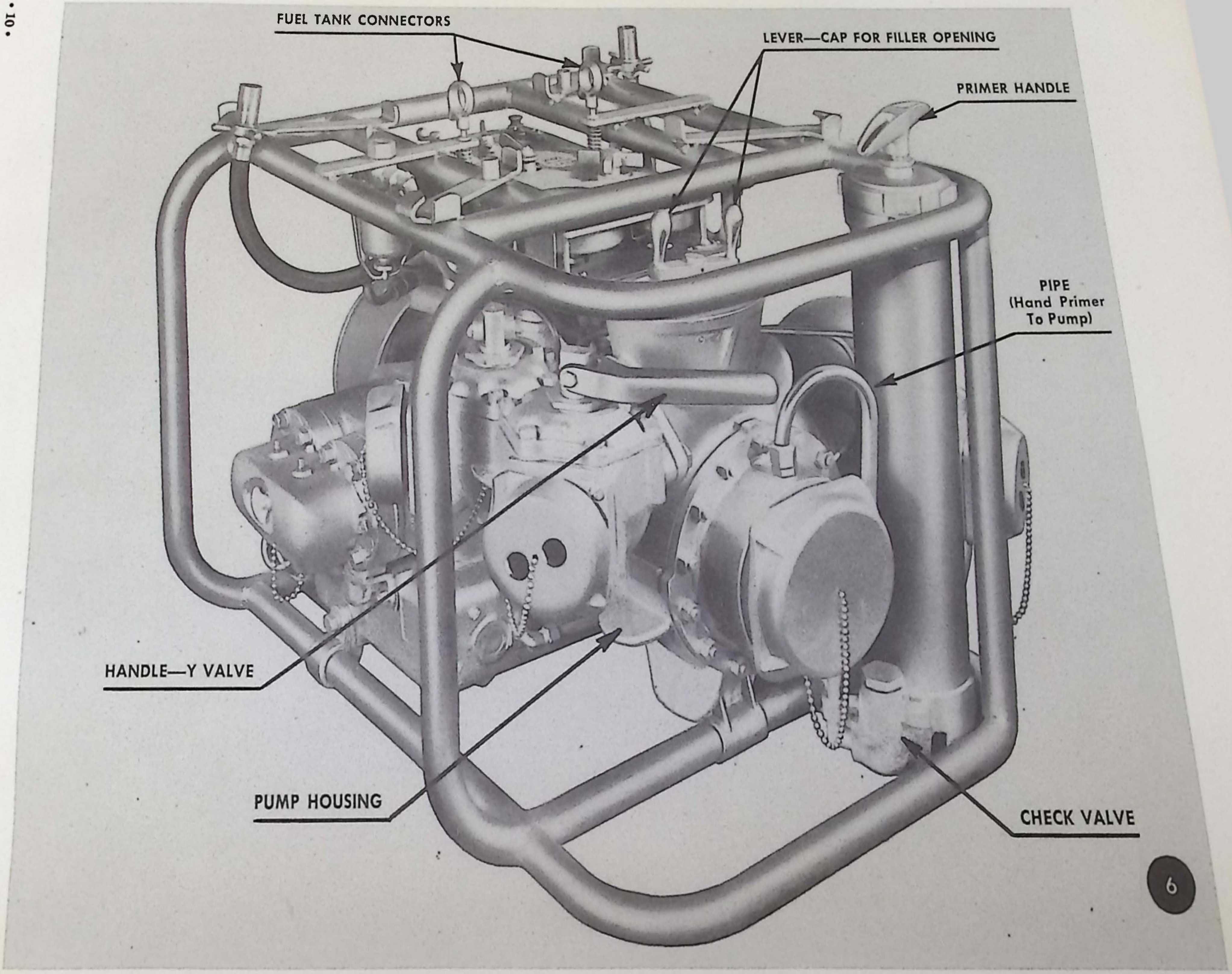

HAND PRIMER
PUMP FRAME
CONTROL PANEL
RECEIVER (Exhaust)
SPRAY SHIELD (Carburetor Underneath)
EXHAUST HOSE CONNECTION
STARTING PULLEY
SPARK PLUG GROUND BUTTONS
SPARK PLUG COVER
FLYWHEEL NUT
CONTROL CYLINDER
FLYWHEEL (Magneto)
DRAIN TUBE
MUFFLER (Exhaust)

4

COMPLETE UNIT, LESS FUEL TANKS—ENGINE END

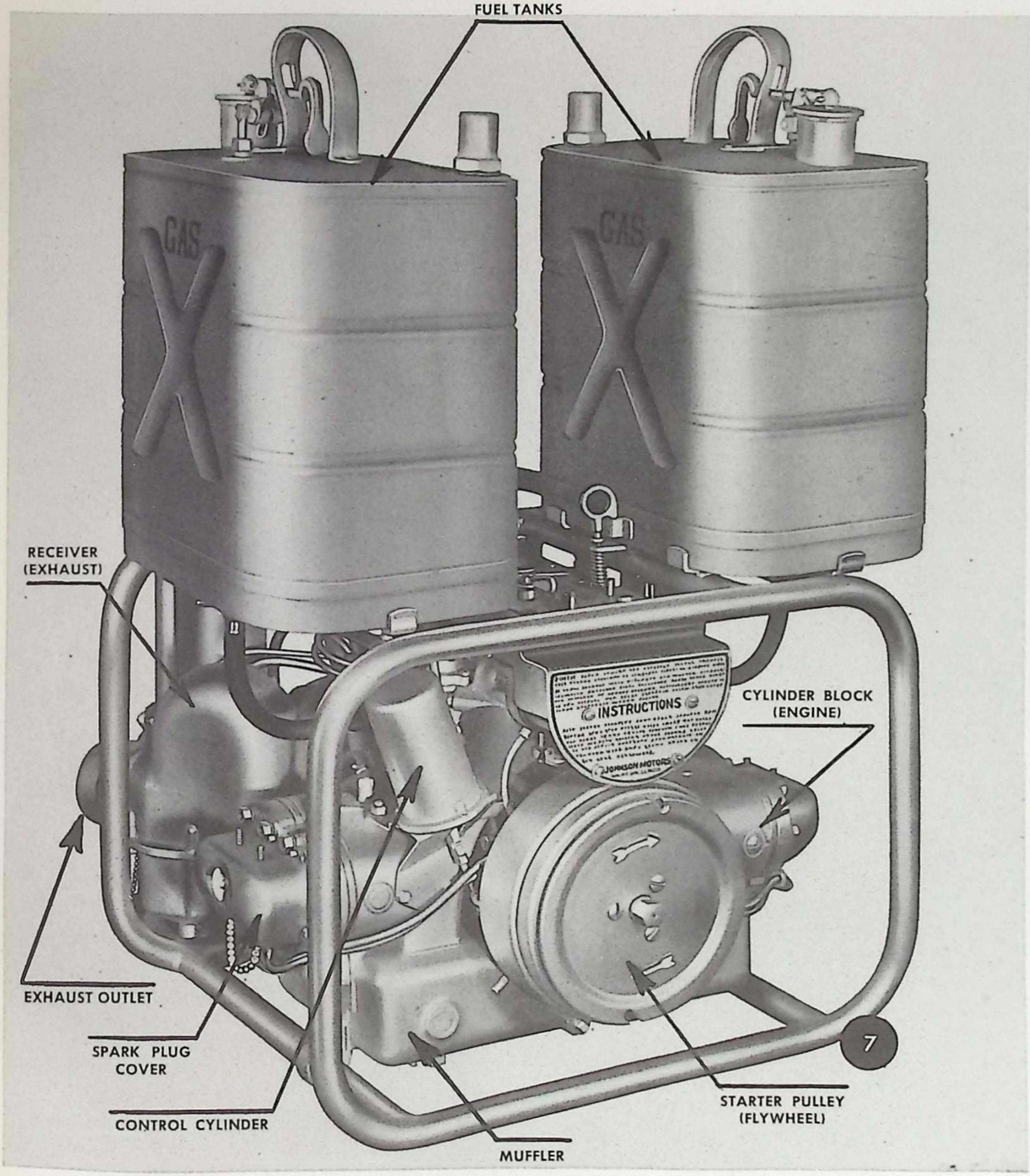

TEMPERATURE GAUGE
PRESSURE REGULATING VALVE
PRESSURE GAUGE
FUEL TANK CLAMP
PRIMER (carburetor)
THROTTLE LEVER
HIGH SPEED NEEDLE LEVER (carburetor)
FLOAT PIN (carburetor)
FUEL VALVE
STOP BUTTON
GAS
REGULATOR VALVE
LEFT TANK
RIGHT TANK
OFF
CARBURETOR PRIMER
SLOW SPEED NEEDLE VALVE
THROTTLE
SLOW
FLOAT PIN
HIGH SPEED NEEDLE VALVE
CLOSE
OPEN
STOP
5

Control Panel


FUEL TANK CONNECTORS
LEVER—CAP FOR FILLER OPENING
PRIMER HANDLE
PIPE (Hand Primer To Pump)
HANDLE—Y VALVE
PUMP HOUSING
CHECK VALVE

6

Complete Unit Less Fuel Tanks, Pump End


FUEL TANKS
GAS
GAS
RECEIVER (EXHAUST)
INSTRUCTIONS
JOHNSON MOTORS
CYLINDER BLOCK (ENGINE)
EXHAUST OUTLET
SPARK PLUG COVER
CONTROL CYLINDER
MUFFLER
STARTER PULLEY (FLYWHEEL)
7

Complete Unit—Pump End

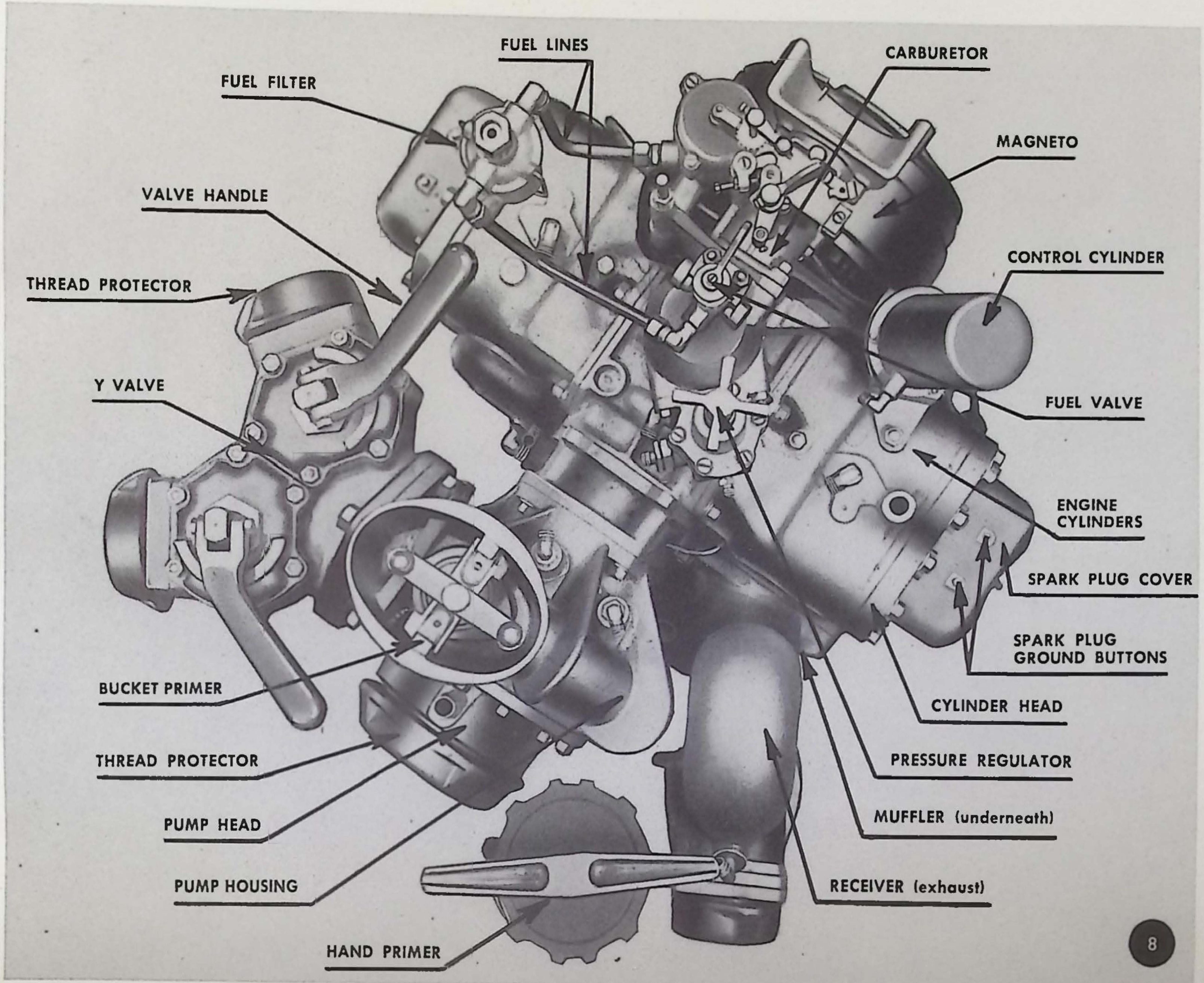
NOTES

JOHNSON

MODEL P-500 PUMP

SECTION II

DESCRIPTION AND OPERATION OF COMPONENT UNITS


FUEL LINES
CARBURETOR
FUEL FILTER
MAGNETO
VALVE HANDLE
CONTROL CYLINDER
THREAD PROTECTOR
Y VALVE
FUEL VALVE
ENGINE CYLINDERS
SPARK PLUG COVER
SPARK PLUG GROUND BUTTONS
BUCKET PRIMER
CYLINDER HEAD
THREAD PROTECTOR
PRESSURE REGULATOR
PUMP HEAD
MUFFLER (underneath)
PUMP HOUSING
RECEIVER (exhaust)
HAND PRIMER
8

DESCRIPTION AND OPERATION OF COMPONENT UNITS

The Model P-500 Pump as a unit is made up of these principal component units:

(a) The engine.
(b) The pump.
(c) Water outlet valves.
(d) Fuel (Gasoline) tanks.
(e) Regulator—pressure.
(f) Control cylinder.
(g) Hand primer.
(h) Control panel and gages.
(i) Exhaust muffler and receiver.

There are in addition these accessories:

(a) Foot-valve and strainer.
(b) Suction hose.
(c) Exhaust hose.
(d) Pressure hoses.
(e) Nozzles.

And for extremely high lifts, an Eductor. Under some conditions of operation, also another type of foot-valve and water intake.

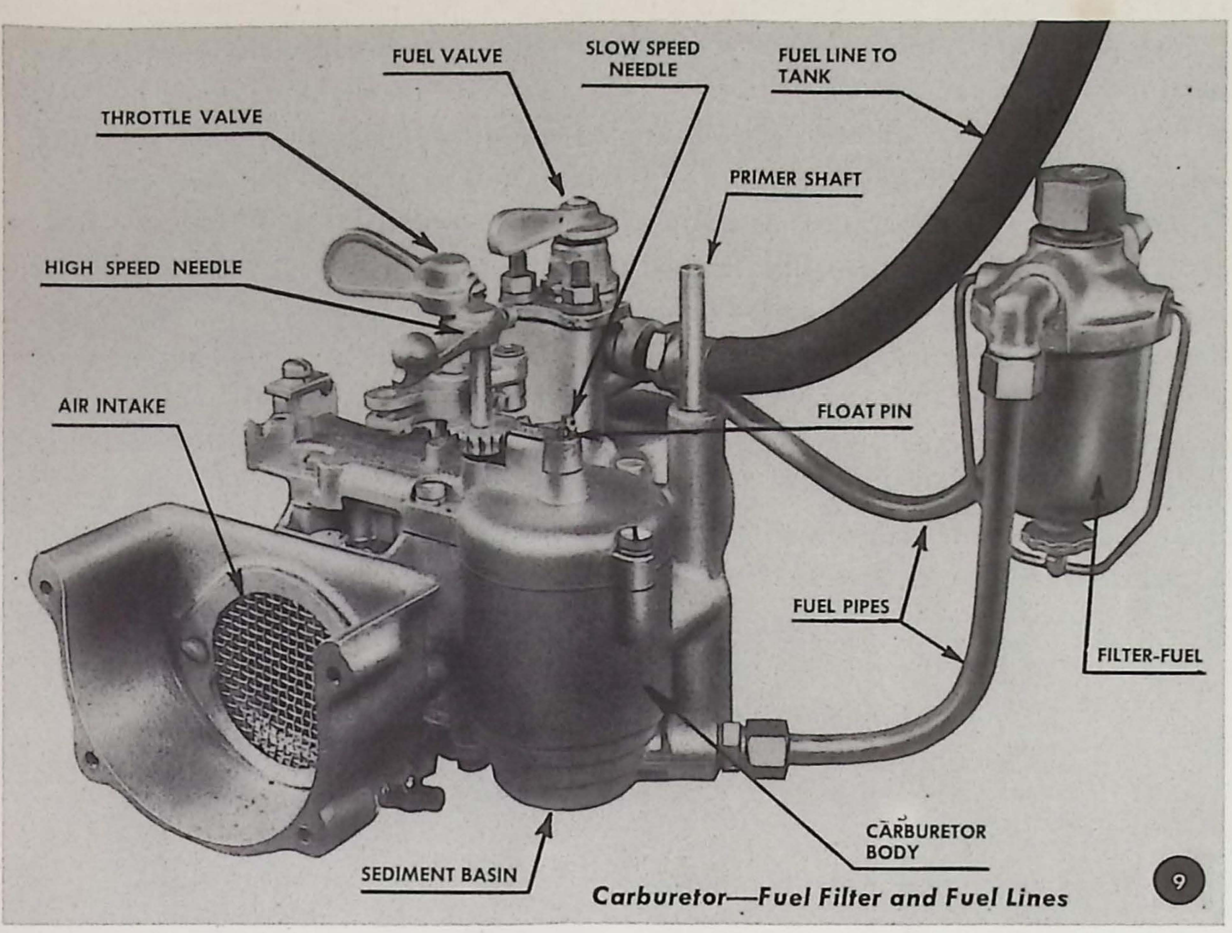
The purpose of this complete equipment is to draw water from the sea (or other source) and to pump it through suitable hoses and nozzles under high pressure to fight fire. It is also used for large volume at low pressure as in salvage work. It is self-contained and portable so that it may be used when other pumping means is unavailable or inadequate or under such conditions that this unit is the most suitable.

THE ENGINE (The Power plant—including muffler and receiver)

The engine creates power by (a) drawing in fuel (oil and gasoline mixed) and air, (b) compressing the combustible mixture in the cylinder, and (c) igniting, and burning, the compressed mixture.

The *Carburetor*—See Fig. 9—is the device into which the air and fuel are introduced to be mixed into a combustible charge. The air is "sucked" in by the movement of the pistons creating a partial vacuum in the crankcase. As it passes through the carburetor venturi at high velocity, it draws fuel from the jet openings in the correct amount depending on the amount of air. The fuel is drawn from the carburetor bowl in which it is kept at constant level by the float valve. The needle valve which is placed in the opening between the float bowl and the jet may be turned one way or the other to let more or less fuel pass through. The throttle valve (butterfly valve) is a "damper" in the air opening which may likewise be turned to more or less restrict the flow (amount) of air. The needle valve is used to change the *ratio*

NOTES


FUEL VALVE
SLOW SPEED NEEDLE
FUEL LINE TO TANK
THROTTLE VALVE
PRIMER SHAFT
HIGH SPEED NEEDLE
AIR INTAKE
FLOAT PIN
FUEL PIPES
FILTER-FUEL
CARBURETOR BODY
SEDIMENT BASIN
9

Carburetor—Fuel Filter and Fuel Lines

of fuel to air; the throttle is used to change the *amount* of air and, therefore, the amount of combustible mixture and, therefore, the power of the engine and consequently the *speed* of the engine.

After the combustible mixture leaves the carburetor it flows through the rotary valve on the crankshaft (between the two crankcases) and within the crankcase. This rotary valve directs the flow at the right time first to one and then the other crankcase of the engine.

After the combustible mixture enters the crankcase, the pistons reverse their direction and compress it in the crankcase. As the pistons approach the end of the downward motion, the pistons uncover the transfer port in the cylinder wall and the compressed combustible mixture rushes through it into the cylinder above the piston (this takes place simultaneously in each of the pair of opposed cylinders).

Compression in the cylinder occurs next as the piston moves upward again covering the transfer port and the exhaust port and trapping the mixture.

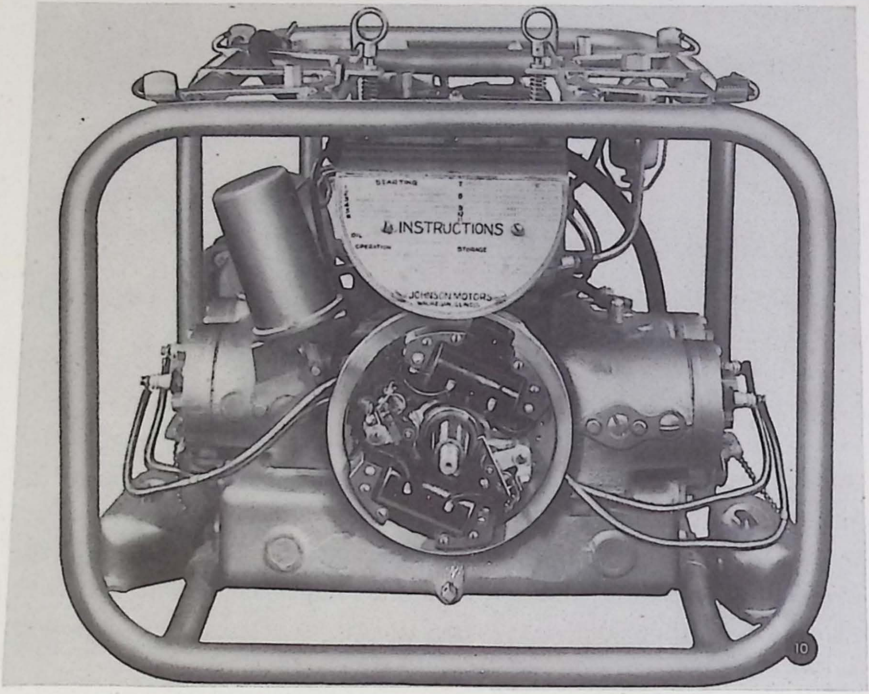
Ignition occurs just before the maximum compression is attained and the mixture burns violently, pressing forcefully on the piston as it starts on its downward motion.

Exhaust takes place as the piston, nearing the end of its downward motion, uncovers the exhaust port and lets the hot gases flow out. An instant later the transfer port is also uncovered and the fresh charge flows in.

Ignition is caused by an electric current of high voltage jumping the gap in the spark plug.

This electric current is produced in the *magneto* which in this instance is built into and in connection with the flywheel. (Flywheel type of magneto.) The magneto consists of a rotating permanent steel magnet (in the flywheel) and the magneto plate which is the stationary component. The magneto plate carries the *coil* and its integral iron core and pole heels; the *breaker,* with movable breaker arm and contact point, and stationary contact point, which "breaks" or interrupts the primary electric current which in turn creates the high tension (high voltage) current which is carried by the high tension leads to the spark plugs; and the condenser which helps control the breaking of the primary electric current. There are two coils, two breakers, two condensers and two pairs of high tension leads. Each set of these components serves two cylinders.

The magneto makes the current; the high tension leads carry it to the spark plugs; the spark plugs provide the well insulated gap across which the current flows to make the spark. This spark, hot and properly timed, ignites the compressed combustible mixture.



Showing Magneto—Flywheel Removed

Lubrication is provided in the engine by the oil which previously had been mixed with the gasoline and was drawn in through the carburetor. The gasoline in the fuel vaporizes in the engine, the oil does not. In the form of very fine particles or droplets it reaches all moving surfaces and forms an oil film to prevent metal-to-metal contact and wear and abrasion. The crankshaft bearings, the connecting rod bearings, the pistons and the cylinder walls, all are so lubricated. Excess oil is transferred to the cylinder along with the combustible mixture and is there burned or is passed out with the exhaust.

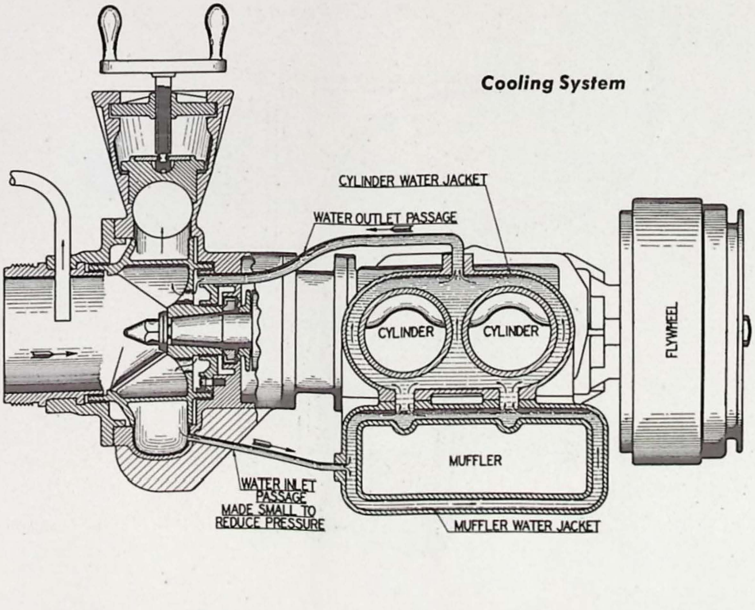
Cooling of a gasoline engine is necessary to prevent metal parts from reaching extremely high temperatures. If these temperatures were not controlled the oil film on moving metal parts would burn, the parts would rub and wear and abrade. Further, the high temperature of the metal in the cylinder, cylinder head and spark plug would ignite the new charge of combustible mixture before the proper time and prevent the engine from running.

In the Model P-500 Pump engine the cooling is provided by water jackets or passages around the cylinders and in the cylinder heads and muffler. This water is forced through the jackets from the pressure side of the pump (part of the water being pumped is thus diverted for this purpose). Water from the pump first enters the jackets of the muffler (which must also be cooled), the cylinder heads, then to the cylinders, and then back into the suction or intake side of the pump. Fig. 11.

Another water pipe from the pump carries cooling water to the *Receiver* wherein it enters the hot exhaust gases serving to further cool and contract them and to make the rubber exhaust hose practical. Part of this water passes out the exhaust hose with the exhaust gases, part is allowed to drain through the float valve in the bottom of the receiver.

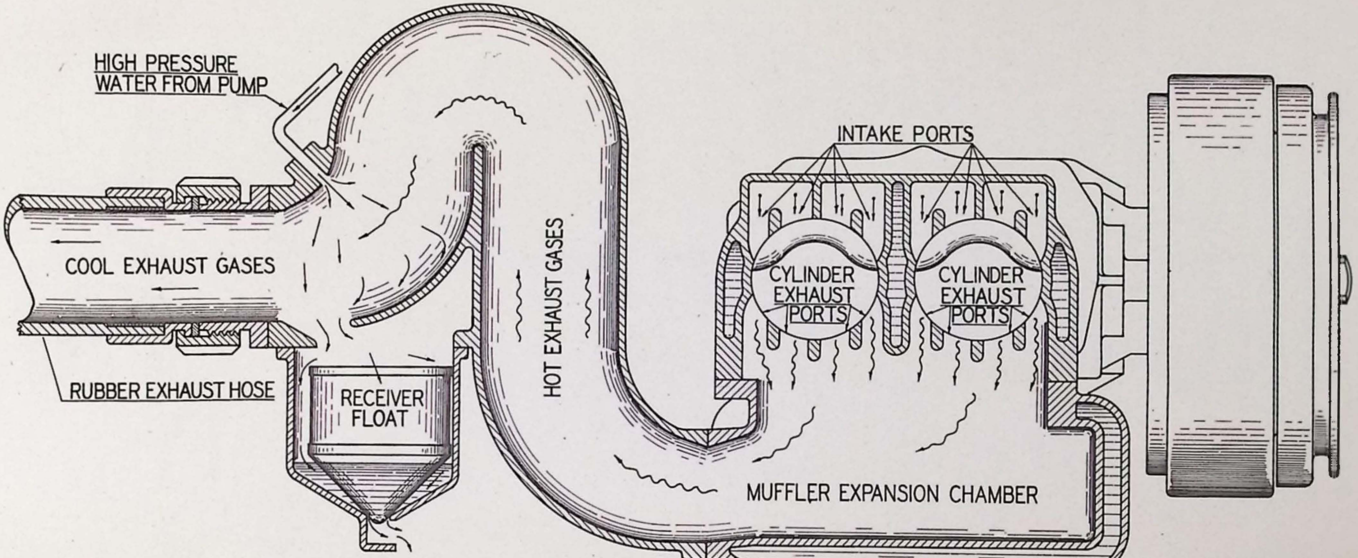
The *exhaust system* is comprised of a *muffler* which is mounted just below the engine and serves as a base, into which the exhaust gases flow directly from the cylinders. This aluminum chamber is water-jacketed. After some expansion in the muffler, the gases flow into the *receiver* wherein water is sprayed into the exhaust gas stream to further cool and contract the gases. The receiver is shaped to prevent water from flowing back into muffler and cylinders. From the receiver the gases, with some water vapor, are carried away by the *exhaust hose,* a standard 2½-inch suction-type (not pressure-type) hose. Fig. 12.

The exhaust hose carries the poisonous exhaust gases to a distance from the pump and to the open air when the unit is operated in a closed space.



Cooling System

11


HIGH PRESSURE WATER FROM PUMP
COOL EXHAUST GASES
RUBBER EXHAUST HOSE
RECEIVER FLOAT
HOT EXHAUST GASES
INTAKE PORTS
CYLINDER EXHAUST PORTS
CYLINDER EXHAUST PORTS
MUFFLER EXPANSION CHAMBER

12

Exhaust System

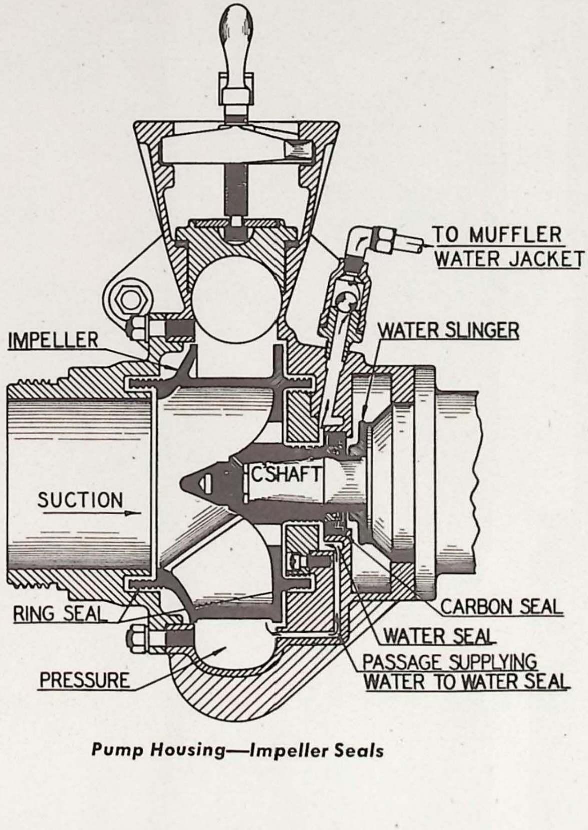
THE PUMP

The pump *housing* is securely attached directly to the engine crankcase; the extended crankshaft of the engine extends into it. Carried on this shaft is the *impeller* which when rapidly rotated forces the water from the housing. From the top of the pump housing, extending in a horizontal direction is the water discharge opening. On the face of the pump farthest from the engine is the intake opening to which is attached the suction (intake) hose.

The incoming water enters the pump at the center of the impeller. The rotating blades force it to the outside of the housing at high velocity and high pressure. It emerges from the housing through the discharge opening.

A pump *seal* is mounted in the housing between the engine and the pump to (a) prevent leakage of water from the pump toward the engine, and (b) to prevent leakage of air into the pump, when priming or running.

To facilitate priming the pump by the bucket method, an opening, closed by a screw-held, gasketed cap, is provided on top of the pump housing. This cap is removed while water is poured in and must be closed tightly before the unit is put into operation. When priming with the hand primer (suction) this cap and its gasket must not allow air to enter at this point.

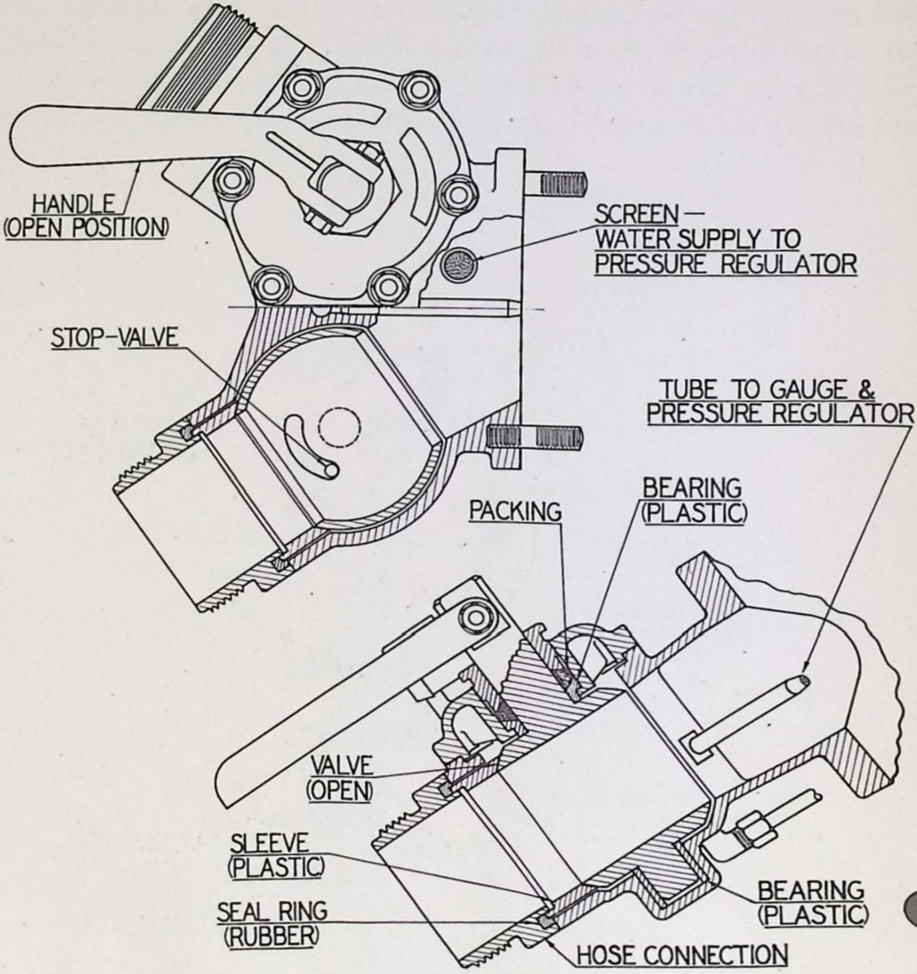

TO MUFFLER
WATER JACKET
WATER SLINGER
IMPELLER
C SHAFT
SUCTION
CARBON SEAL
RING SEAL
WATER SEAL
PASSAGE SUPPLYING
WATER TO WATER SEAL
PRESSURE

⑬

Pump Housing—Impeller Seals

WATER OUTLET VALVES (Y-Valves)

Attached to the water discharge outlet of the pump housing is the Y-Valve—a branching body containing two valves each of which controls the flow of water to one of the two pressure hose lines. The valve consists of a metal ball with a hole through it. Pressing against this ball is a plastic sleeve. When the valve is in the "Open" position, the water flows straight through the body, through the ball, through the sleeve and thence into the hose. When the valve is in the "Closed" position (turned 90 degrees) the surface of the ball bearing against the end of the sleeve seals the passage; water cannot pass, air cannot enter during the priming operation. The ball is moved or turned by means of an outside handle which is lifted slightly from its stop and then moved; when in the full "Open" or the full "Closed" position the handle falls into a notch which holds the valve in place. There are no intermediate positions—it is full on or full off and should always be used that way.

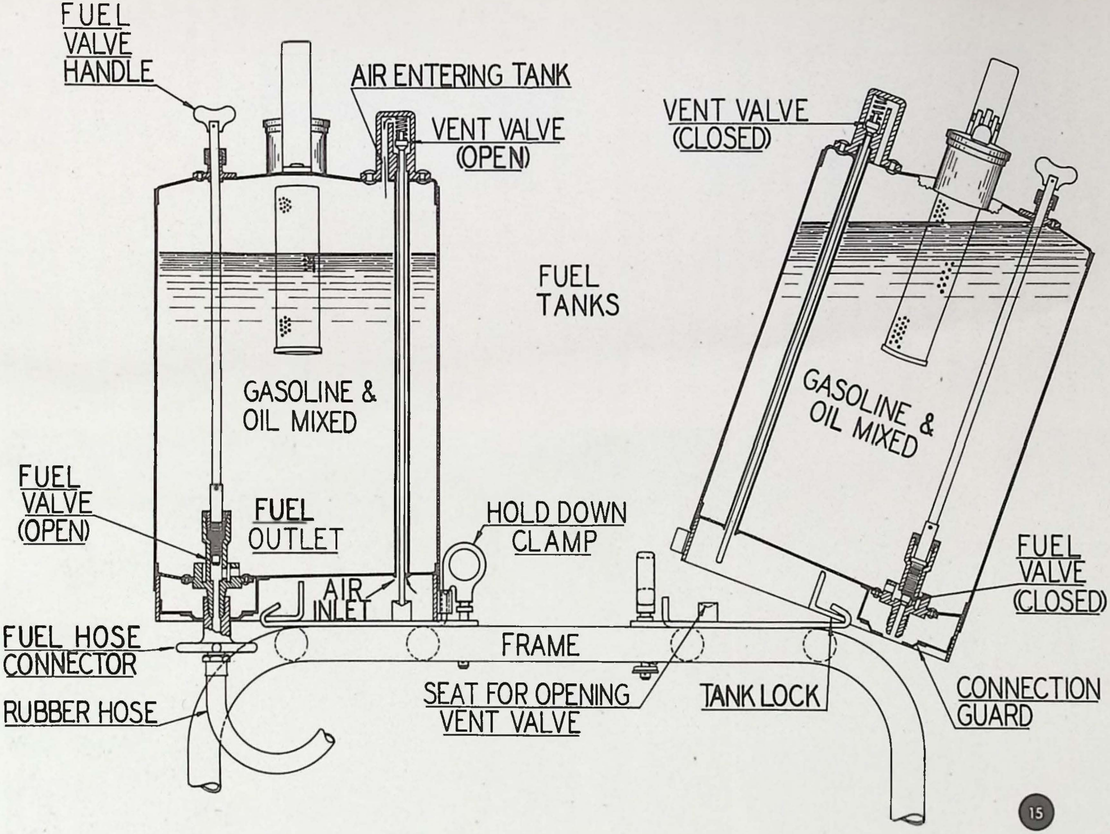

HANDLE
(OPEN POSITION)
SCREEN—
WATER SUPPLY TO
PRESSURE REGULATOR
STOP-VALVE
TUBE TO GAUGE &
PRESSURE REGULATOR
BEARING
(PLASTIC)
PACKING
VALVE
(OPEN)
SLEEVE
(PLASTIC)
SEAL RING
(RUBBER)
BEARING
(PLASTIC)
HOSE CONNECTION

⑭

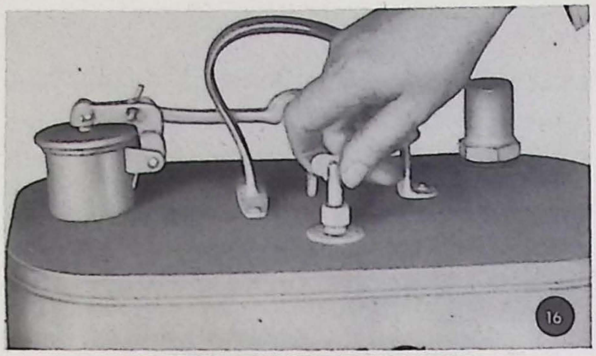
Y-Valve Section

FUEL TANKS

Two gasoline tanks (fuel) are supplied with each unit. While fuel is being used from one the other may be removed for refilling. A valve located on the *control panel* is used to select one or the other tank.


FUEL VALVE HANDLE
AIR ENTERING TANK
VENT VALVE (OPEN)
VENT VALVE (CLOSED)
FUEL TANKS
GASOLINE & OIL MIXED
GASOLINE & OIL MIXED
FUEL VALVE (OPEN)
FUEL OUTLET
HOLD DOWN CLAMP
AIR INLET
FUEL VALVE (CLOSED)
FUEL HOSE CONNECTOR
FRAME
RUBBER HOSE
SEAT FOR OPENING VENT VALVE
TANK LOCK
CONNECTION GUARD
15

Automatic Vent Valve and Filler Neck



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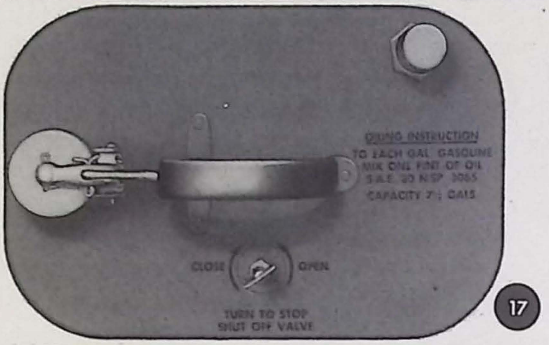
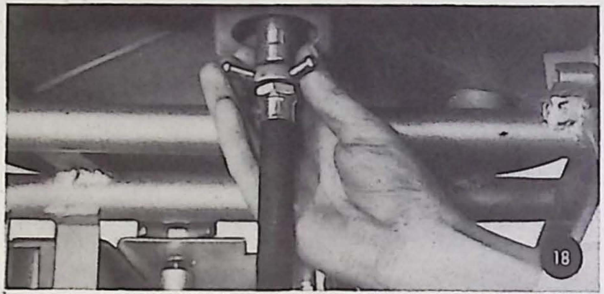


17



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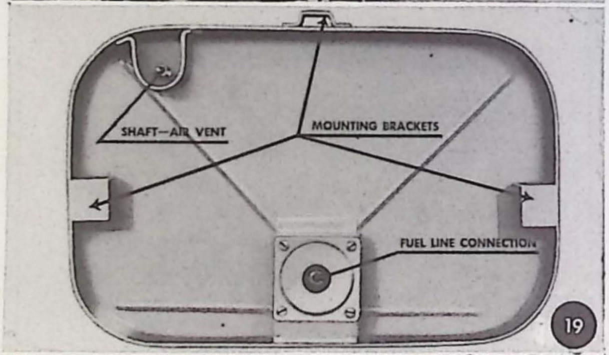
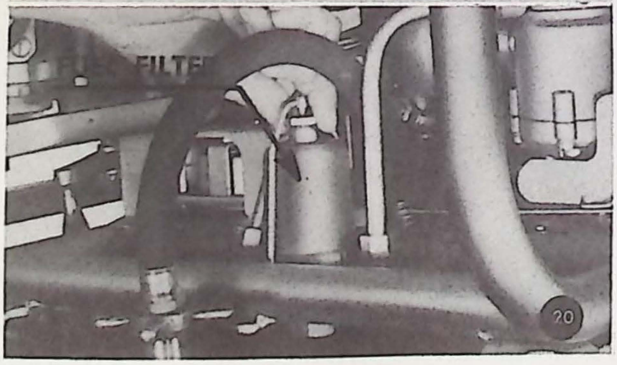


19



20

Located inside the carrying handle on top of the tank is a grip-lever which when pulled with the fingers raises the gasketed cap over the filler opening—a spring keeps it normally closed for safety. The thumb-screw valve, also located on top the tank, is the gasoline *shut-off valve,* Fig. 15, 16. This is screwed closed before removing the tank from the unit; is screwed open when the tank is in position on the unit and after the fuel hose has been connected at the bottom. On top of the tank is also located the *automatic vent-valve* cover, Fig. 15, 17. One tank holds 7½ gallons of fuel mixture sufficient for operation slightly over one hour.

On the bottom of the tank is the fuel hose connection, the fuel outlet, Fig. 15, 18. Also, there protrudes a rod which extends upward through the tank to the automatic vent-valve mounted on top. When the tank is mounted in its proper location on the unit, this rod is pushed upward opening the vent-valve so that air can enter the top of the tank as the fuel is drawn off from the bottom, Fig. 15. A spring closes this valve when the tank is removed from the unit—no manual operation is required by operator.

The tanks are attached to the unit as illustrated, see Fig. 42, 43, and held securely in place by the frame hooks on the outer side and the spring catch on the inner side.

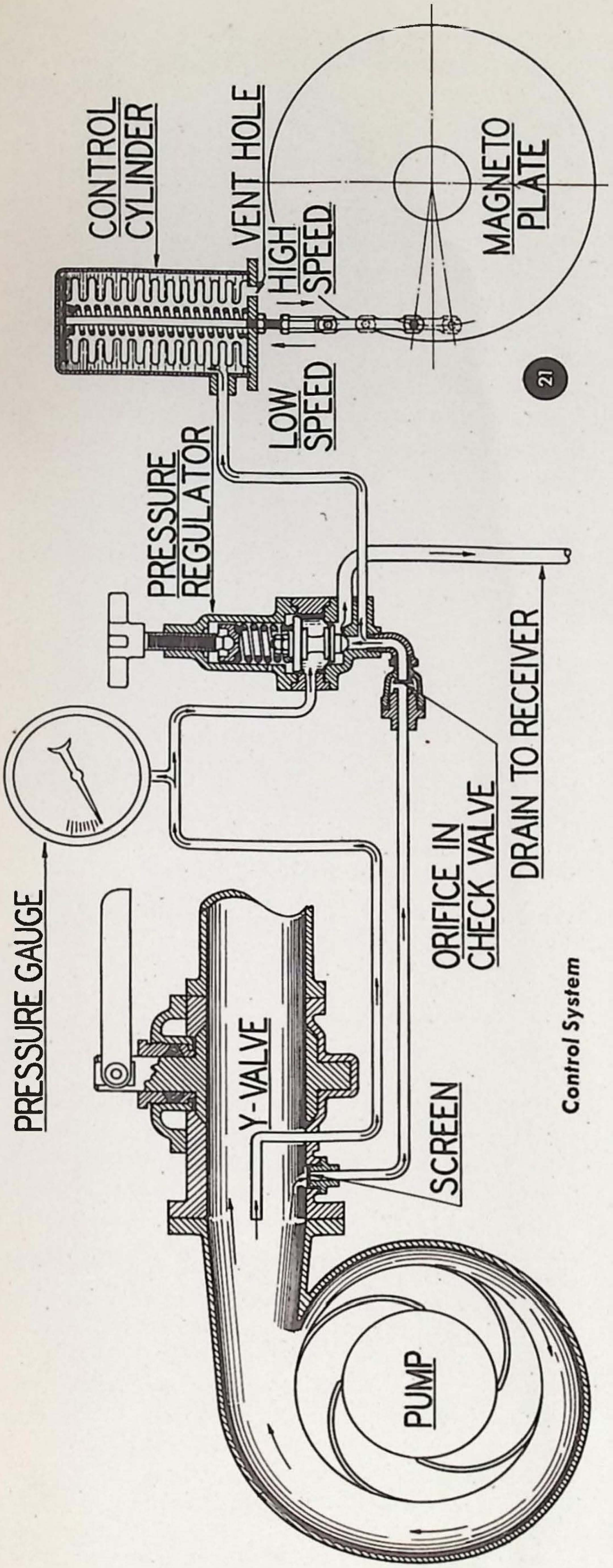
FUEL FILTER (and Water Trap)

The liquid fuel flows from the fuel tanks through the fuel hose to the fuel filter mounted on the frame near the carburetor. This basin is a brass bowl, containing a filter or straining unit, arranged for easy and quick removal of any dirt, sediment or water which it may trap from the fuel passing through it. The filtering element should (if possible) be cleaned by washing with alcohol to remove dirt and gum.

REGULATOR—PRESSURE

The (pressure) Regulator is mounted on the carburetor manifold elbow (on top the crankcase) with its adjusting-screw handle protruding above the control panel. By means of the adjusting-screw the pressure of the water delivered by the pump may be adjusted from 75 pounds per square inch to up around 140 pounds per square inch (but dependent on the volume of water being delivered).

Inside the regulator are two diaphragms interconnected to form a differential diaphragm operating a small valve. Water from the Y-valve body enters the regulator through a small pipe. Water


CONTROL CYLINDER
VENT HOLE
HIGH SPEED
LOW SPEED
MAGNETO PLATE
21
PRESSURE REGULATOR
DRAIN TO RECEIVER
ORIFICE IN CHECK VALVE
PRESSURE GAUGE
Y-VALVE
SCREEN
PUMP

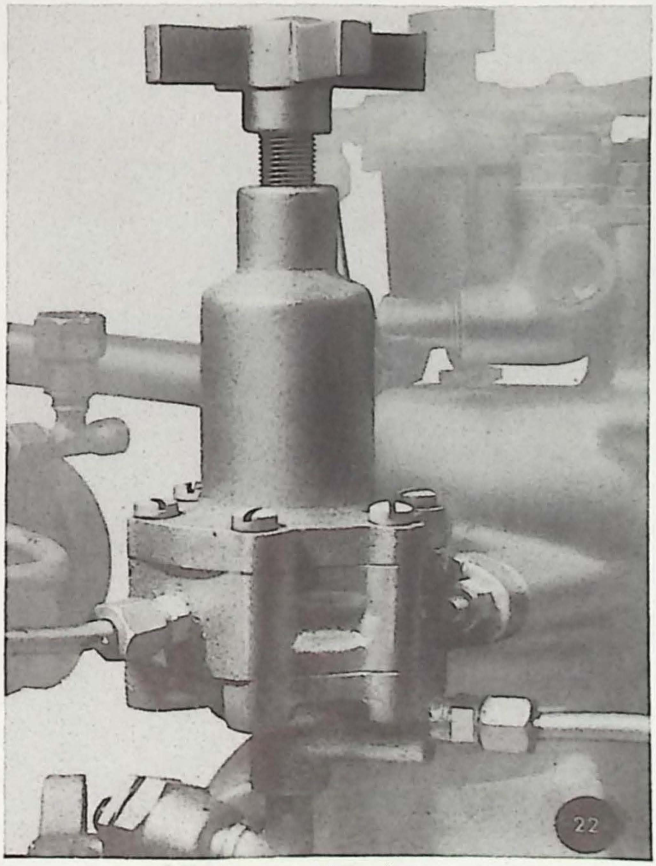
Control System

flows from and to the regulator through a pipe connected to the *control cylinder.*

When the pump unit is not running there is no water pressure in the Y-valve or the regulator or the control cylinder. The control cylinder then holds the throttle valve of the carburetor closed (nearly so) and retards the spark. This is the proper position for starting.

When the unit is running with the regulator set at, say, 100 pounds per square inch, pressure flows to the regulator and thence to the control cylinder which then moves to open the throttle valve and advance the spark (more power). If the pressure then goes above 100 pounds, the regulator valve is opened by the movement of the differential diaphragm and lowers the pressure in the control cylinder which then closes the throttle valve and retards the spark (slightly). This tends to slow down the engine enough to maintain the pressure at 100 pounds and to not permit the pressure to go above 100 pounds (or whatever pressure the regulator is set for).

The regulator does double duty. Not only does it govern the engine to hold the high pressures as above described, but it also acts as a safety device when the pump is not primed.

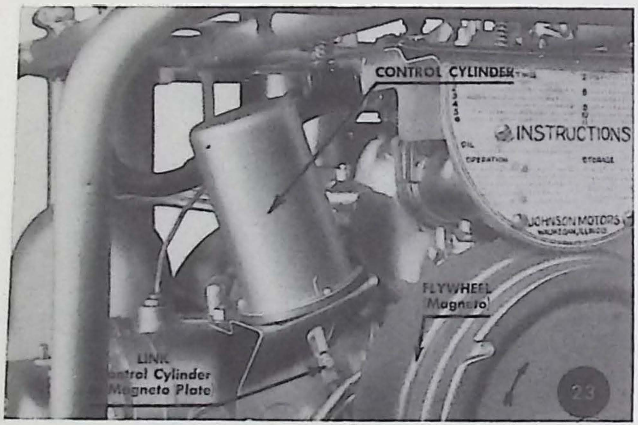


Pressure Regulator

If the engine is started without being properly primed (under which condition it cannot pump water), or should the unit when running lose its prime (as when the foot valve is lifted from the water allowing air to enter) then the regulator and control cylinder will close the throttle and retard the spark and permit the engine to run only at part throttle. If this were not done, the engine, without load, would "race" to dangerously high speeds. The fact that there is no water pressure in the pump or Y-valve, and none in the regulator and control cylinder under these conditions, permits the control cylinder to return the throttle and spark to the throttled setting.

CONTROL CYLINDER

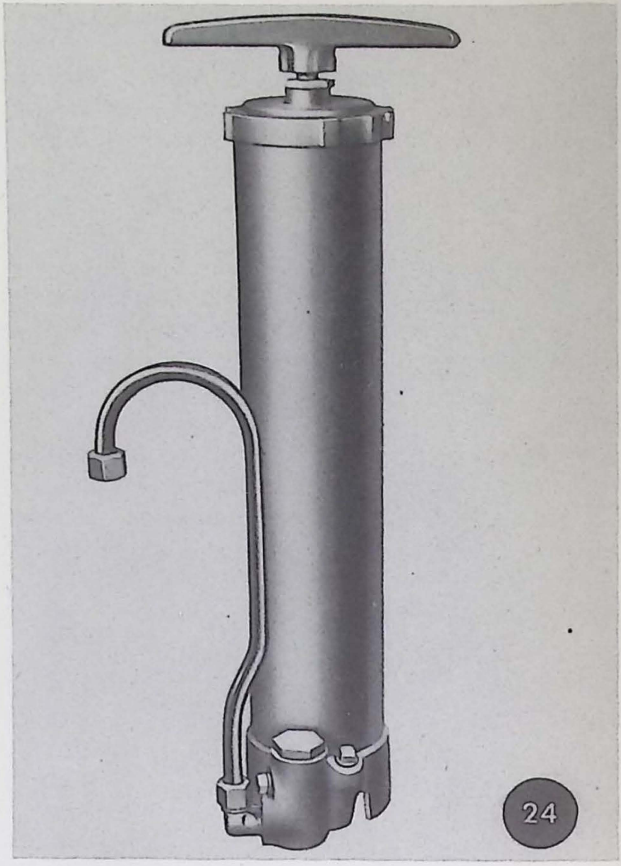
The control cylinder is mounted on the left cylinder block of the engine near the flywheel. Its extending rod or linkage is connected to the armature plate of the magneto. This rod is normally (idle unit) in the contracted position and holds the magneto plate in the retarded spark position. The magneto plate, near the top, is in turn connected by a linkage with the lower end of the throttle valve in the carburetor, so when the plate is moved by the control cylinder rod, the throttle valve is likewise moved. The actuating means (as explained under "regulator" above) is water pressure provided by the pump and controlled by the regulator.



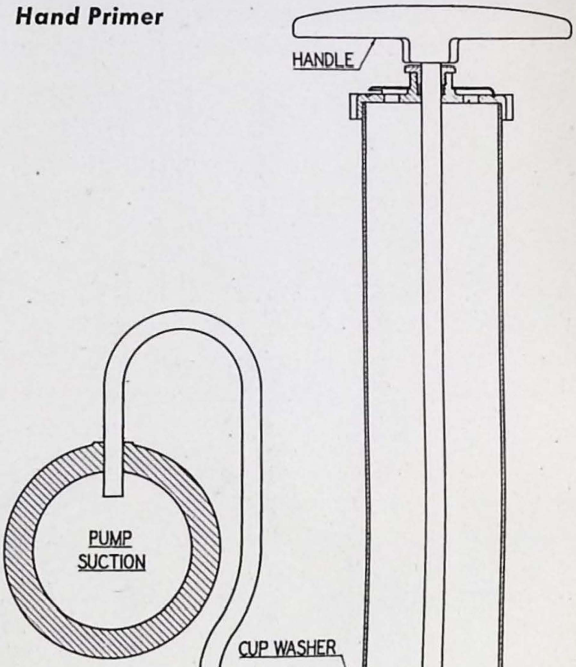
Control Cylinder

HAND PRIMER (Pump primer)

A centrifugal type of pump will not pump water unless it is primed, unless all the air is removed and replaced with water, before it is started. In normal operation (suction lift not over 16 feet), priming of the Model P-500 Pump may be accomplished in either of two ways: (a) The hand primer may be used to draw all the air from the pump body



Hand Primer



Primer

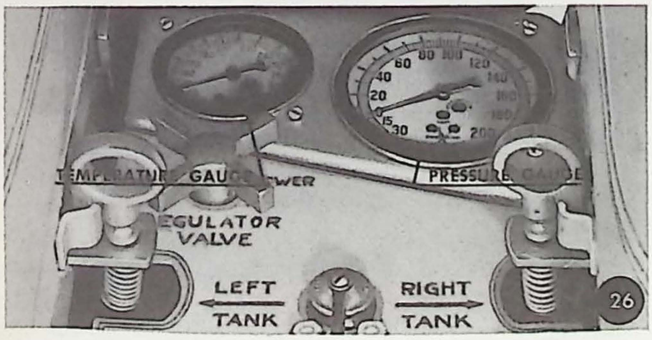
and suction hose (in which case the water will rise in the suction hose to fill them if the lift is not over 16 feet). (b) The pump body and suction hose may be filled with water by pouring the water into the opening on the top of the pump housing (normally closed with the screw-cap). In this case there must be a tight foot valve on the lower end of the suction hose to keep the water from running out.

The hand primer, located in the frame near the receiver, is a "bicycle pump" in reverse; the valves are so made that it sucks air *out* rather than forcing air *in.* By moving the handle up and down, vigorously, until water instead of air enters the primer, the pump and suction hose is filled with water. The hand primer is connected to the pump housing by a pipe in which is a ball check valve. The plunger is fitted with a "cup washer" of special material which will not ordinarily dry out or harden or stick.

CONTROL PANEL

The control panel is mounted over the engine and carburetor between the fuel tanks. At the top (farthest from the operator) are the gages: (a) Pressure gage which shows the pressure of the water being delivered by the pump. (b) Heat gage or thermometer which shows the temperature of the engine cylinders. The heat gage is marked to show in red the temperature range which is dangerous (the engine should be stopped when the temperature reaches this range).

The screw handle of the regulator (pressure) is also located on the control panel. The gasoline valve which controls the flow of fuel from the right or the left tank; the gasoline adjusting needle valve which extends down to the carburetor; the stop button which when depressed "shorts out" the sparks from the magneto for stopping; a lever which is attached to the carburetor throttle valve and which may be used to manually close the throttle (but not open it); a small hole through which the float valve pin in the carburetor bowl may be observed for position (whether the bowl is full or empty) and opening for adjustment of slow-speed needle valve, all are likewise mounted conveniently on the control panel plainly and conveniently marked.

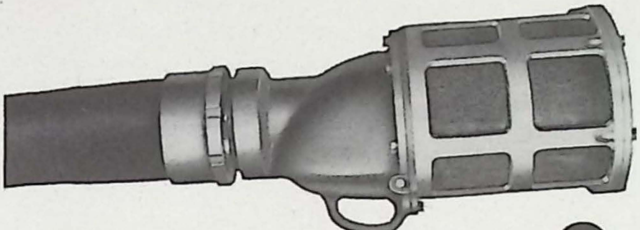


26

Control Panel

FOOT VALVE AND STRAINER
(Combination)

The foot valve and strainer is screwed to the lower end of the suction hose. In the body is a flap valve which is spring loaded to closed position and which lets water flow upward freely but closes and prevents water from running back. Below this is a heavy screen of ample area to not hinder the inward flow of water but which excludes coarser debris and foreign matter which would injure the pump



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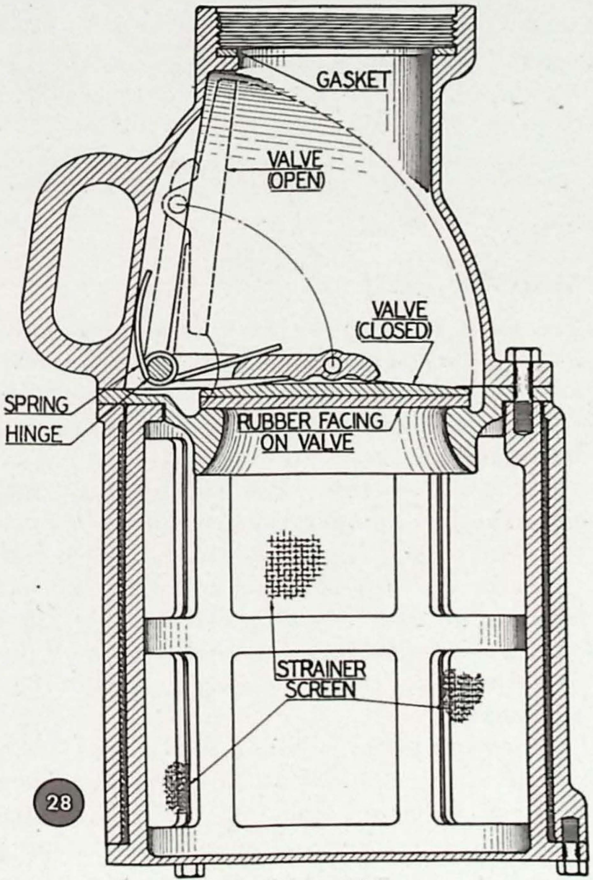
Foot Valve and Strainer



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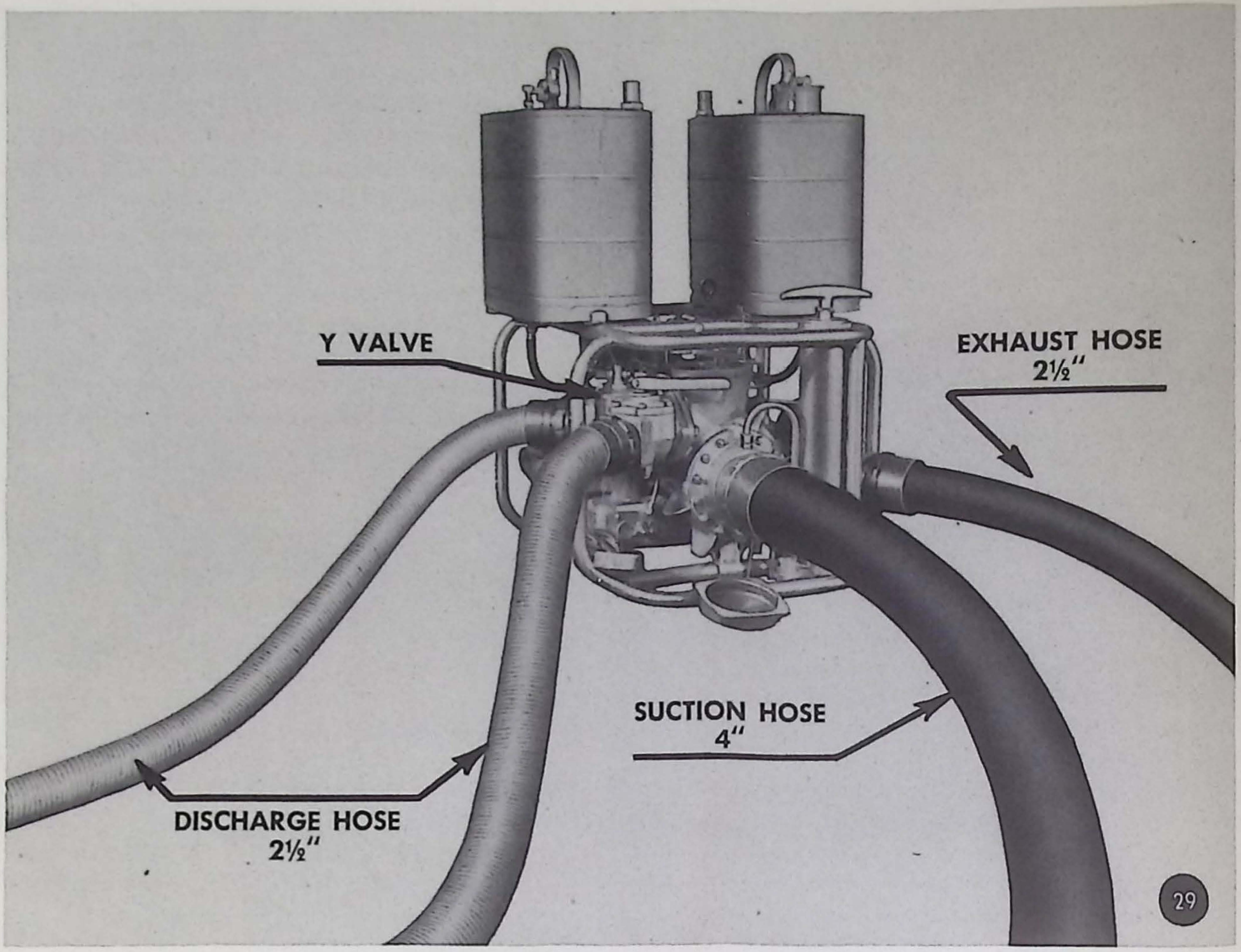
Foot Valve Assembly



Hoses Connected

SUCTION HOSE

The suction hose is the Navy Standard Specification four (4) inch rubber hose with standard screw connections at each end. One end is screwed to the pump intake and to the other is attached the Foot Valve and Strainer.

To avoid air leaks, the Suction Hose must be sound and free from cracks or holes; the fittings at each end must be tight; and the gaskets at each end (between the hose coupling and the pump intake—between the hose coupling and the Foot Valve and Strainer) must be in good condition and tight. The couplings must be screwed up tight with the spanner wrench.

When the pump is being primed and when it is in operation, the suction hose carries a negative pressure (vacuum) and must neither collapse or leak air. Further, the suction hose must be supported by a line as its weight should not be allowed to hang on the pump.

It is of utmost importance that the suction hose does not rise above the level of the pump intake at any point; it should fall away from pump to water in a continuous downward slope.

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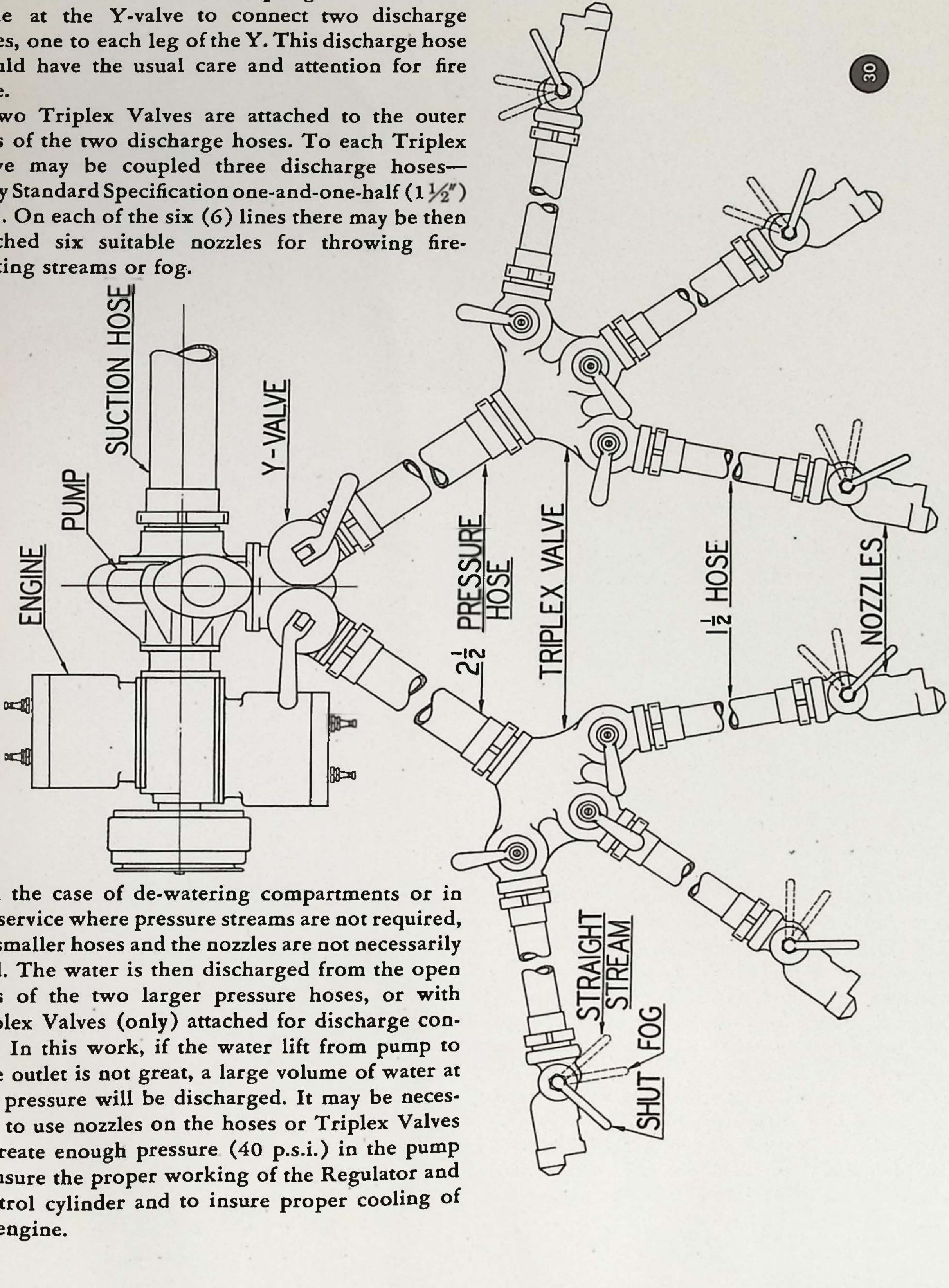
EXHAUST HOSE

The Exhaust Hose is the Navy Standard two-and-one-half (2½") inch *suction type* rubber hose. A flexible, collapsing hose, such as discharge linen hose, is not suitable. The Exhaust Hose is attached by means of the standard coupling to the pump Receiver. In operation it carries both engine exhaust gases and water. It should not be over about twenty-five feet in length unless necessary and since there is some oil in the exhaust gases, it should have a synthetic rubber lining. It should rise continuously from the point of connection to the Receiver to prevent forming a water pocket.

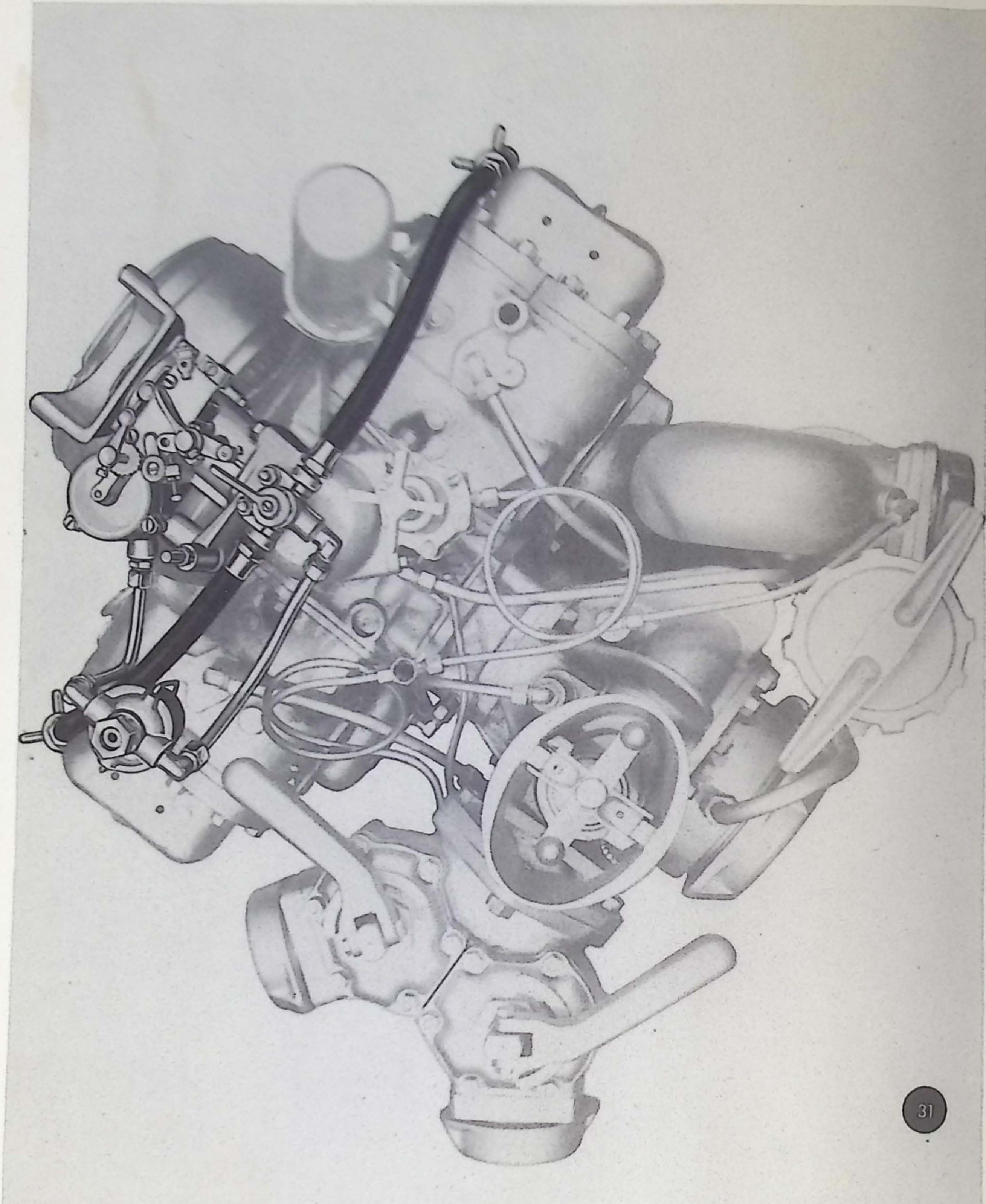
PRESSURE (Discharge) HOSE

The Discharge Hose is the Navy Standard Specification two-and-one-half (2½″) inch linen pressure hose with standard hose couplings. Provision is made at the Y-valve to connect two discharge hoses, one to each leg of the Y. This discharge hose should have the usual care and attention for fire hose.

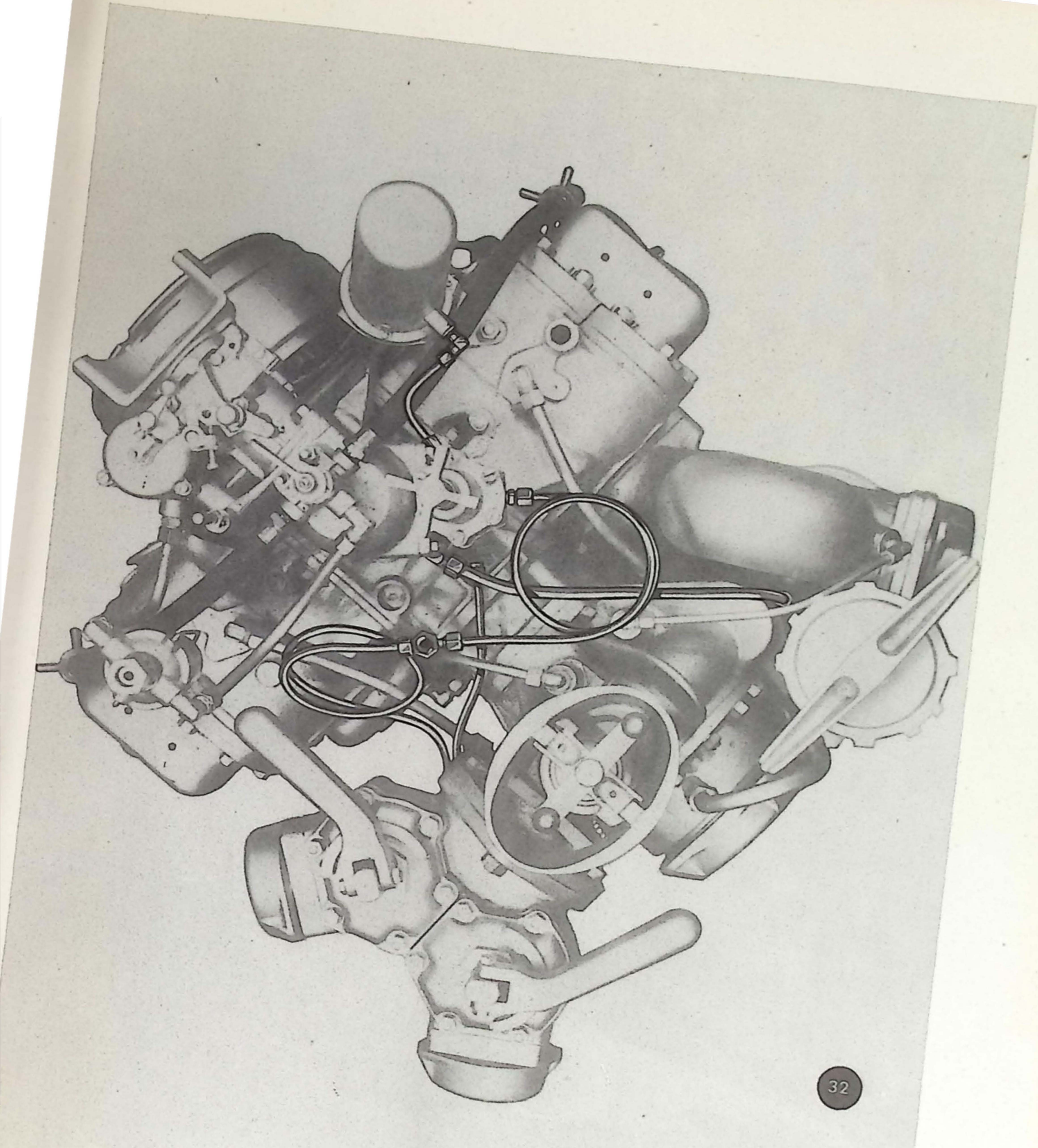
Two Triplex Valves are attached to the outer ends of the two discharge hoses. To each Triplex Valve may be coupled three discharge hoses—Navy Standard Specification one-and-one-half (1½″) inch. On each of the six (6) lines there may be then attached six suitable nozzles for throwing fire-fighting streams or fog.



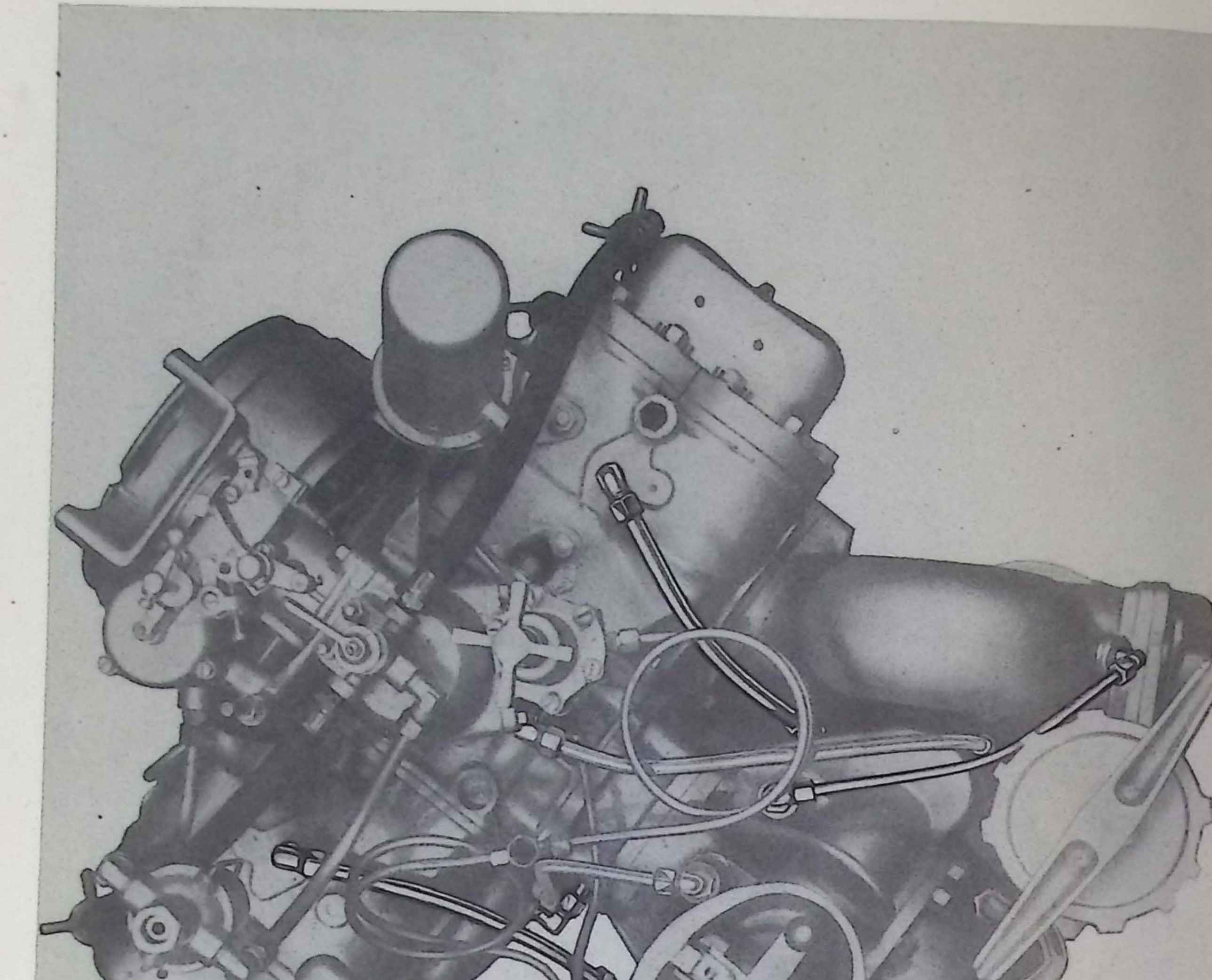
In the case of de-watering compartments or in any service where pressure streams are not required, the smaller hoses and the nozzles are not necessarily used. The water is then discharged from the open ends of the two larger pressure hoses, or with Triplex Valves (only) attached for discharge control. In this work, if the water lift from pump to hose outlet is not great, a large volume of water at low pressure will be discharged. It may be necessary to use nozzles on the hoses or Triplex Valves to create enough pressure (40 p.s.i.) in the pump to insure the proper working of the Regulator and Control cylinder and to insure proper cooling of the engine.



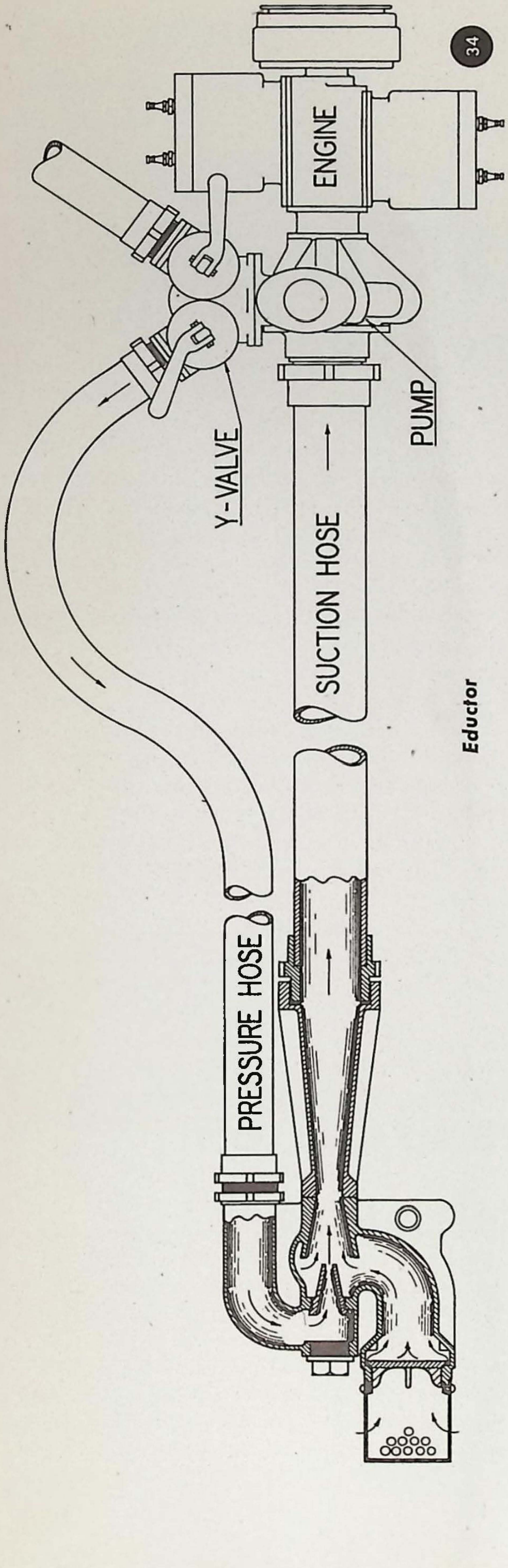
Piping—Fuel System



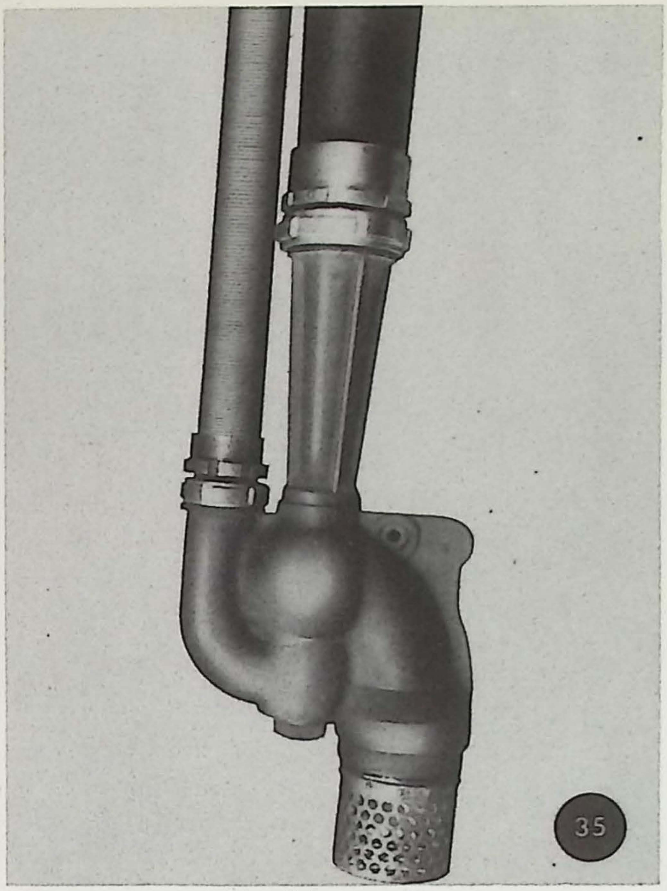
Piping—Regulator System



Piping—Cooling System



Eductor



Eductor

EDUCTOR—For suction lift over 16 feet.

This unit is not supplied by the pump manufacturer but is furnished separately by the Navy only to the larger vessels receiving the Model P-500 Pump.

When in use it is attached to the lower end of the Suction Hose instead of the regular Foot Valve and Strainer. One of the 2½-inch pressure hoses from the Y-valve is connected to the pressure connection of the Eductor. The Eductor must be fully submerged.

The discharge of approximately 250 gallons per minute at 100 pounds per square inch pressure from the pump unit through the Eductor raises the water part of the distance to the pump while the suction of the pump itself raises it the rest of the way. Thus, suction lift of more than 16 feet may be accomplished.

A built-in foot valve and a strainer are part of the Eductor.

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JOHNSON

MODEL P-500 PUMP

SECTION III

DESCRIPTION AND OPERATION OF COMPONENT UNITS

Operating Facts

JOHNSON MODEL P-500 PUMP

The Johnson Model P-500 Pump is designed to deliver 500 gallons per minute at a discharge pressure of 100 pounds per square inch when operating at a suction lift of 16 feet.

The *Eductor* which has been designed to be used with this pump when operating at suction lift greater than 16 feet, requires approximately 250 gallons of the pump delivery water when operating at a pressure of 100 pounds per square inch. When the Eductor is in use, therefore, only about 250 gallons per minute is available for fire fighting.

When the pump is operating at 16 feet (or less) suction lift and discharging through two 2½-inch hoses fitted with 1⅛-inch nozzles, the pump discharge pressure can be expected to drop to less than 100 pounds per square inch—probably to around 75 pounds. When discharging through six 1½-inch hoses fitted with Navy Standard nozzles, the pump discharge pressure can be expected to be maintained at 100 pounds per square inch.

When the pump is operating at suction lift greater than 16 feet with the Eductor in use, the discharge pressure should remain at 100 pounds per square inch regardless of whether the discharge is through one 2½-inch hose fitted with a 1⅛-inch nozzle or through three 1½-inch hoses fitted with Navy Standard nozzles.

When the pump is used for pumping large volumes of water at low pressure (as in salvage operations), two 2½-inch hoses should be connected to the Y-valve. On the opposite ends, the regular Triplex Valves (two shipped with each unit) should be attached. The Triplex Valves should then be suitably lashed down to prevent movement caused by the reaction of the discharged water. Close all three of the valves on one Triplex Valve—leave all three open on the other. Start the pump with the Y-valves closed. As soon as pressure builds up, slowly open both Y-valves. Open the valves on the closed Triplex Valve one at a time until the pressure as shown on the Pressure Gage drops to about but not below 35 pounds per square inch. DO NOT ALLOW PRESSURE TO GO BELOW 35 POUNDS or the control system will cause the engine to slow down. Do not let it exceed 35 pounds for if the pressure is substantially higher there will be some loss in the water (volume) output. Operating at suction lift of approximately 3 feet, the pump should deliver approximately 700 gallons per minute at 35 pounds per square inch, or at suction lift of 16 feet, around 600 gallons per minute.

Fuel

GASOLINE AND OIL MIXTURE

The Model P-500 Pump is lubricated by the oil which is mixed with the gasoline. There is no other lubrication. It is therefore of extreme importance that the *right grade* of oil be mixed in the *right proportions,* with the gasoline.

Fuel Mixture: ONE PINT of engine *oil,* U. S. Navy No. 3065 (S.A.E. No. 30) is to be added to each gallon of gasoline.

Each fuel tank has a capacity of seven and one-half (7½) gallons of fuel.

Pour into the Fuel Tank three (3) gallons of gasoline, then pour into the Fuel Tank six (6) *pints* (3 Quarts) of the right oil. Then vigorously shake the Fuel Tank—tilting far to either side—until the gasoline and oil are thoroughly mixed. Measure into the Fuel Tank three (3) more *gallons* of gasoline. Shake vigorously again.

If the Fuel Tank is not completely empty, mix the gasoline and oil in a separate container and then fill the Fuel Tank.

Gasoline. The Model P-500 Pump will operate satisfactorily on 80 octane (medium grade, leaded) gasoline; or on 100 octane aviation gasoline. (*Note:* A little more carburetor priming for starting may be necessary with the lower grades of gasoline. And less with the 100 octane aviation gasoline.)

Operating Instructions

JOHNSON MODEL P-500 PUMP

NEW UNIT—Unpacking

The box in which the Model P-500 Pump is packed and shipped contains: (a) The pump unit, (b) Two fuel tanks, (c) Foot Valve and Strainer,

(d) Operating Manual, (e) Parts Kit—in canvas bag, tied to frame rail, and (f) Triplex Valves—two.

Remove the lid, top side, of the box carefully and remove the blocking that holds the pump unit and other components in place. It will probably be necessary to remove sides also. Remove U-bolts that hold frame to base of box.

With a Starting Rope crank the engine vigorously one pull. This will "blow" the corks which have been placed in the spark plug holes in the cylinder heads. Remove the spark plug covers and put in a full set of four new plugs. Screw them down snugly tight. Attach the High Tension leads (spark plug wires from the magneto).

COMPLETE EQUIPMENT FOR OPERATION

Following is a complete list of the equipment needed for the operation of the Model P-500 Pump in fire fighting:

A. Pump Unit

B. Fuel Tanks

C. Fuel—Gasoline and Oil Mixture (to be prepared)

D. Parts Kit (in canvas bag with the pump unit)

E. Spanner Wrenches—for hoses (Not furnished by pump manufacturer)
  One for 4" suction hose,
  One for 2½" exhaust hose and pressure hoses,
  One for 1½" pressure hoses.

F. Hoses—in necessary lengths. (Not furnished by pump manufacturer)
  Suction hose—4" suction type,
  Exhaust hose—2½" suction type,
  Pressure (discharge) hoses—2½" and 1½" as needed.

G. Water distribution valves—Triplex Valves—Two (Shipped with pump unit but not furnished by pump manufacturer)

H. Rope. Various lengths and sizes (Not furnished by pump manufacturer.) for—
  Supporting suction hose,
  Lashing pump unit in place,
  Supporting foot valve and strainer,
  Supporting Eductor, if used.

I. Fire Nozzles—number and type required by conditions (Not furnished by pump manufacturer)

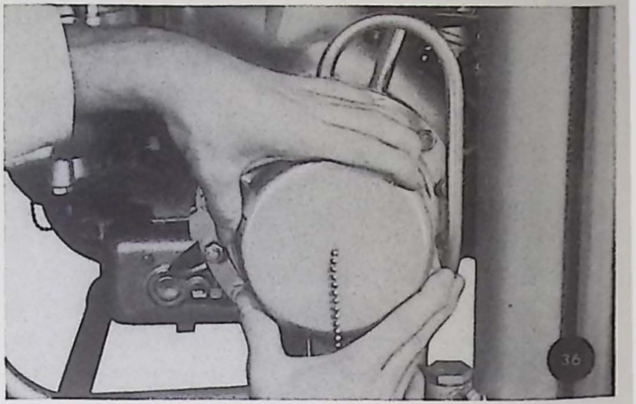
J. Foot Valve and Strainer

K. Eductor—if pumping more than 16 feet suction lift. (Not furnished by pump manufacturer)

Note: The Eductor is not furnished with the pump but is furnished separately by the Navy only to the larger vessels receiving this equipment.

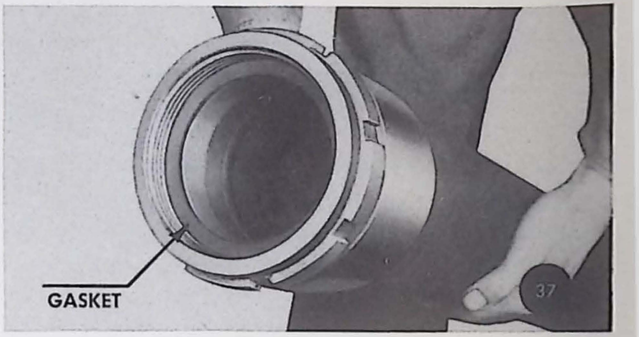
L. Box of Spare Parts and Tools

ASSEMBLY OF EQUIPMENT FOR OPERATION

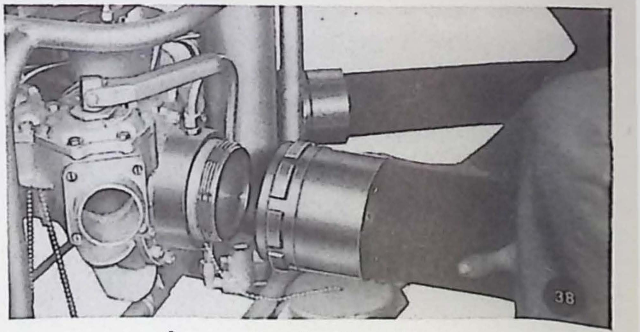


Removing Intake Thread Protector

A. Remove Thread Protectors from—
  Pump intake,
  Receiver, exhaust outlet,
  Y-valves—two.

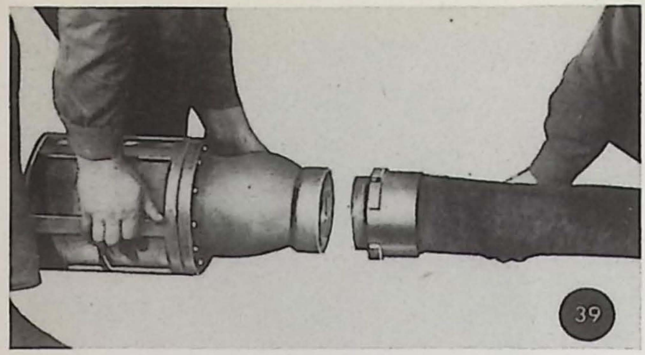


Suction Hose—Showing Gasket



Connecting Suction Hose

B. Attach Suction Hose to pump intake
  Make sure of a good gasket and *AIR TIGHT connection.*

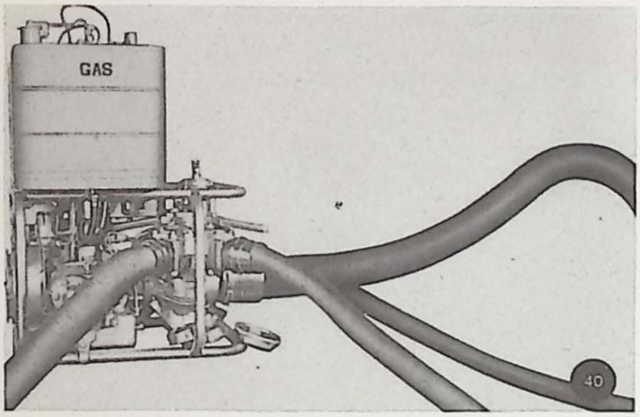


Connecting (a) Suction Hose
(b) Foot Valve and Strainer

C. Attach Foot Valve and Strainer to Suction Hose
Make sure of a good gasket and *AIR TIGHT connection.*

Note: When pump is to be used at a suction lift greater than 16 feet, the Eductor, which contains foot valve and strainer, is used in place of the Foot Valve and Strainer. Also, 2½" pressure hose is used from one branch of Y-valve to pressure connection on the Eductor.

D. Support the Suction Hose with a line.
The weight of the Suction Hose and the attached Foot Valve and Strainer must not be on the pump.

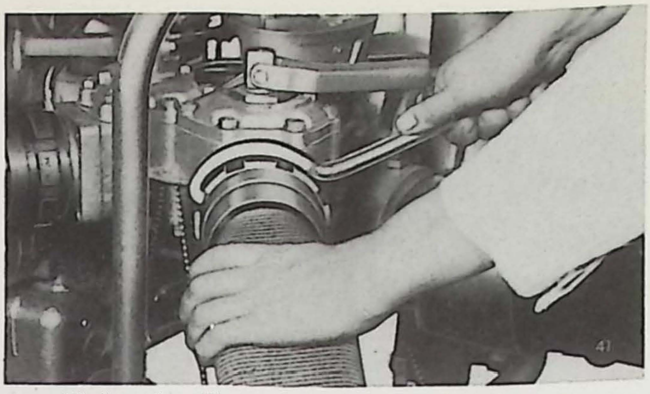


Do NOT Loop Suction Hose Upward as Shown Here

IMPORTANT: Make sure that the Suction Hose slopes away continuously downward from the pump intake. No higher "loop" in the Suction Hose is permissible as it would form an air trap and prevent complete priming.

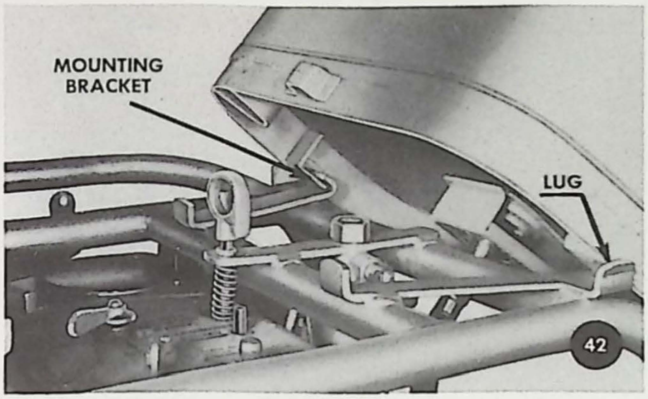
E. Connect Exhaust Hose
Make sure of a good gasket and tight connection.

CAUTION! Exhaust gases MUST be discharged into outside atmosphere (never in a closed space) as they are dangerously *POISON.*

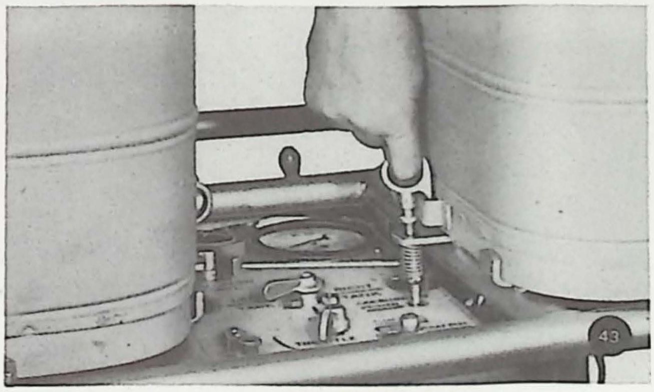


Tightening Hose Connections with Spanner

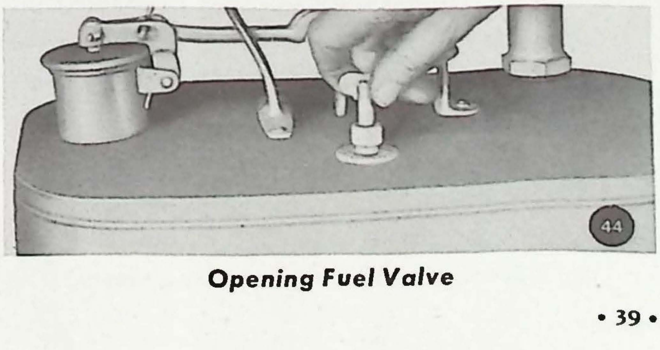
F. Connect Pressure (discharge) Hoses
Make sure of a good gasket and tight connection.



Placing Fuel Tank on Frame

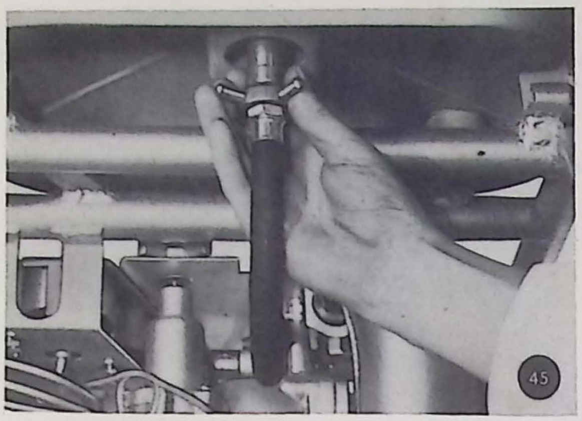


Clamping Fuel Tank to Frame



Opening Fuel Valve

G. Mount filled Fuel (gasoline) Tanks to Unit and connect the two fuel hoses on unit to tanks
  1. Open gasoline valves (on tanks).

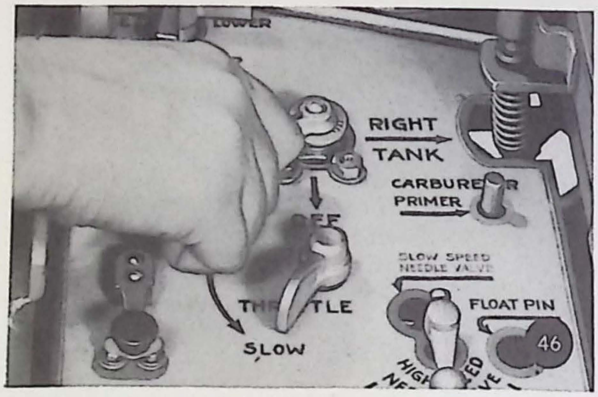


Connecting Fuel Line to Fuel Tank

H. Submerge the Foot Valve and Strainer (on the end of the Suction Hose)
  It must stay COMPLETELY submerged under all conditions during operation—*always.*

Starting

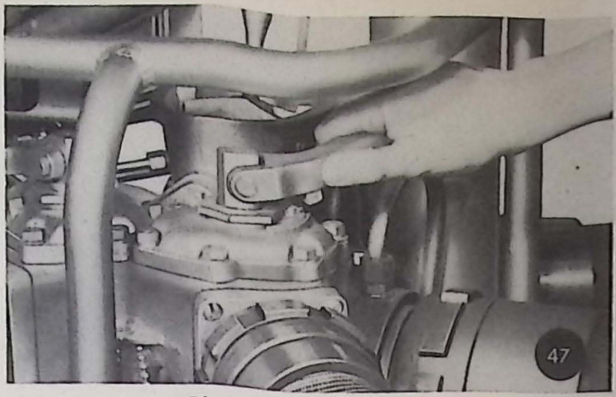
A. Open both Fuel Tank valves (one on each tank)



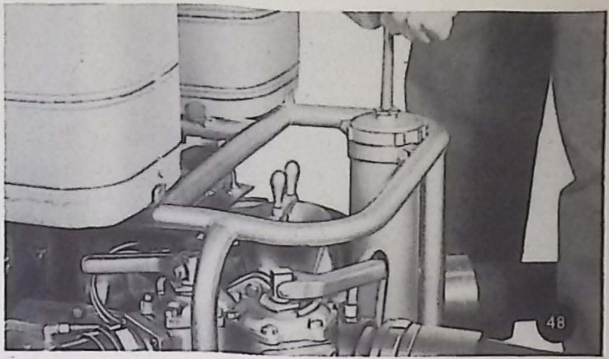
Turning on Fuel

B. Turn Fuel Valve, on Control Panel, from closed position to one of the fuel tanks
  See that the Float Valve Pin in the carburetor bowl rises, indicating the bowl is full of fuel.

C. Close both Y-valves.
  (When the pump is to be used at suction lift greater than 16 feet with Eductor in use, the Y-valve connected to the pressure hose leading to pressure connection on Eductor should be open and the other Y-valves closed.)

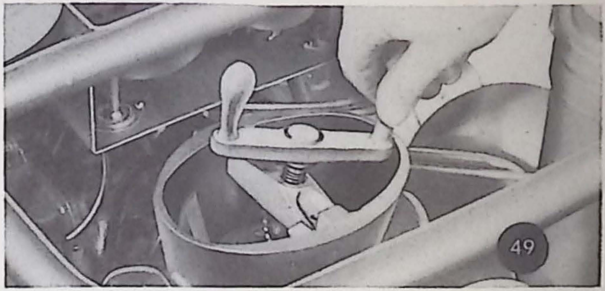


Close Both Y-Valves



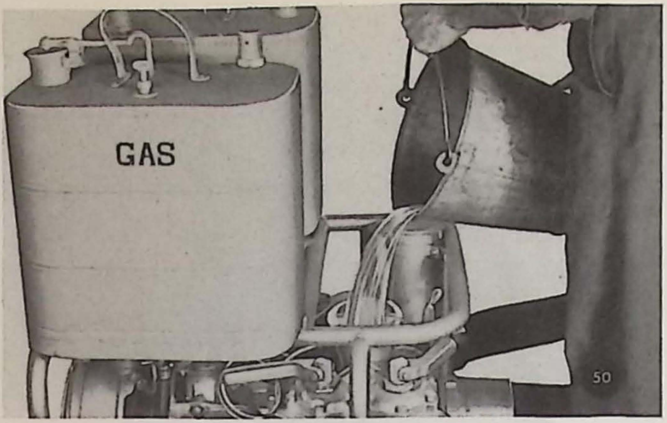
Priming Pump

D. Prime the pump completely.
  1. Operate the Hand Primer plunger rapidly, full stroke, until it suddenly becomes hard to pump, indicating that air is exhausted and water has entered it.

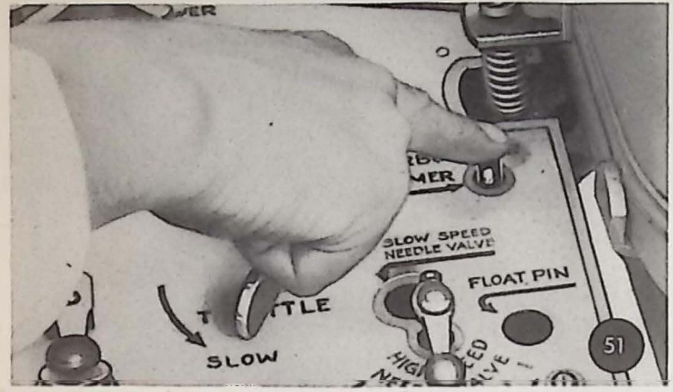


Opening Filler for Bucket Priming

  2. If the bucket method of priming is used, open the filler opening cap on the pump housing and fill with buckets or hose until it is completely full.
  3. When pump is to be used at suction lift greater than 16 feet with Eductor in use, complete priming consists of filling the suction hose, pump housing, and pressure hose to Eductor with water. This cannot be accomplished with the Hand Primer and the bucket method of priming is necessary.

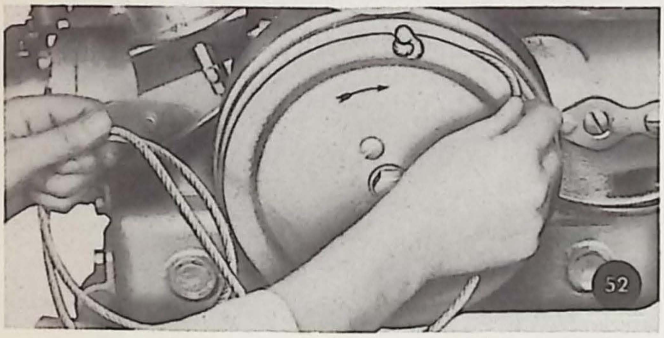


Bucket Priming



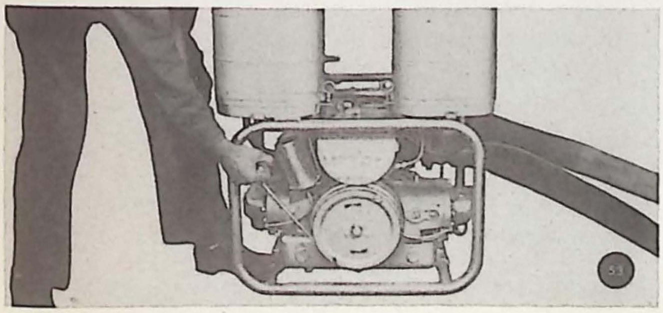
Priming Carburetor

E. Prime the Carburetor on engine (plunger on the Control Panel) FOUR strokes.



Wind Starting Rope on Pulley

F. Wind the Starting Rope on the Starting Pulley on the flywheel.



Pull Starting Rope

G. Pull the Starting Rope.

Pull strongly—don't jerk—to the full length of the rope.

NOTE: If the engine does not start with two pulls, then push the Carburetor Primer plunger *ONCE* and pull the rope again.

If the engine starts but stops at once, push primer, start again, and keep priming as needed until engine warms up.

THEN—WITH THE ENGINE RUNNING—

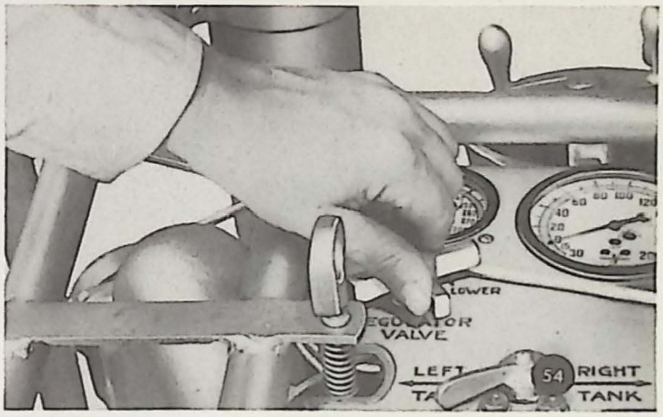
A. Make sure pressure builds up on gage.

B. Slowly open one Y-valve when the pressure on the pressure gage (Control Panel) shows 75 pounds per square inch, or more.

Note: When the Eductor is in use only one Y-valve and hose is available for fire fighting.

C. Readjust Carburetor Needle Valve (on Control Panel) so the engine operates best.

Note this setting for future reference.



Adjusting Water Pressure

D. Adjust water pressure with Regulator (on Control Panel) if necessary.

E. Open the second Y-valve if output required. (Not available when using Eductor.)

NOTE: If the engine does not start and run under the above procedure, check all the above operations and see "Trouble Chart."

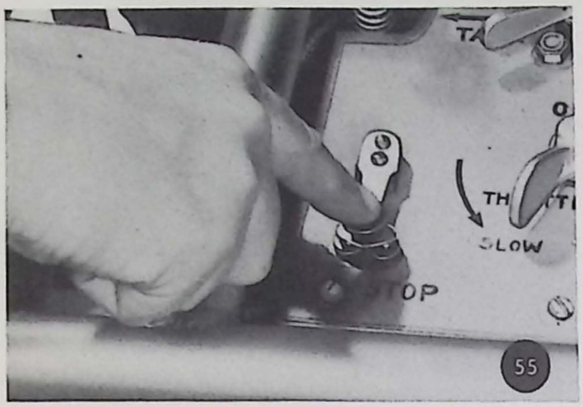
OPERATING

During the whole period of operation of the pump, the attendant should:

A. Watch the water pressure gage and the Temperature gage on the Control Panel.

If the Temperature gage indicator gets over into the "Dangerous" (red) zone on the dial, the unit should be stopped and cause of trouble corrected.

B. Change the fuel supply from one tank to the other tank when one is about empty.
   1. After about one hour of operation at full capacity.
   2. When irregular engine operation or the lowered position of the Float Pin in the Carburetor bowl indicates lack of fuel.



Stopping

C. To Stop Unit—
   Push and hold "Stop" button on the Control Panel until the engine comes to a full stop.

RE-STARTING

When the unit has been operating and is stopped, it may be hot or warm when it is to be re-started. If the Y-valves were closed before stopping and if the foot valve and all hoses and hose connections are tight, the pump will hold its prime and probably will not need re-priming. It will pick up when the engine is operated. But should it not, the Hand Primer may be operated while the engine is running. (*Caution!* Do not run too long without full prime and pressure, or engine will overheat. Watch Temperature Gage.)

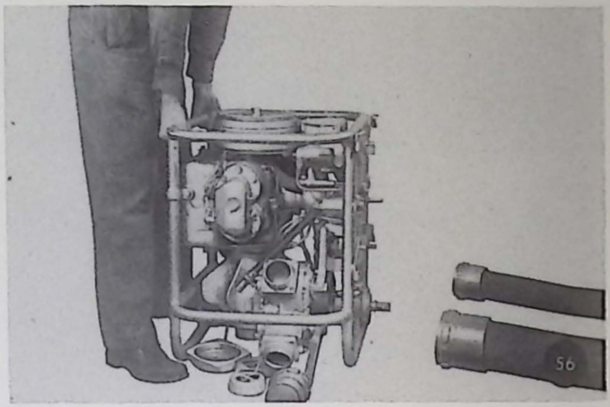
Otherwise, re-starting comprises the same steps as are given above for starting EXCEPT that when the engine is warm or hot (and depending on what the temperature is) it will require less Carburetor priming. Be careful not to flood it when warm.

LAYING AWAY

When the operation for which the pump was used is completed, it should be prepared for lay-away so that it will not deteriorate and so that it will be ready to go back into service instantly when required again.

Stop the engine by shutting off the fuel supply by turning the Fuel Valve (on the Control Panel) to the "OFF" position. This will use up the fuel in the Carburetor bowl.

Shut off the fuel tank valves (on both tanks) and then disconnect the fuel hoses from the tanks. Remove both fuel tanks.



Draining Unit

Disconnect all hoses. Close Y-valves.

Flush out pump unit with fresh water (if available). Drain all water from pump unit—by tipping flywheel end up. Repeat until no more water drains.

Put Thread Protectors on all outlets—four.

Wipe the complete unit dry and clean all over.

For long storage or shipment perform all of the above operations and in addition:

A. Remove all spark plugs.

B. Pour about one tablespoonful of engine lubricating oil into each cylinder through the spark plug hole.

C. Rotate the engine slowly by hand about four revolutions to distribute the oil.

D. Replace the spark plugs and the spark plug covers.

Whether lay-away is for short or long periods, the hoses should be drained and dried, if possible. Gaskets should be inspected and if damaged or torn should be replaced.

All equipment should be accessible and available for instant use when required and should be in the most perfect operating condition.

In order to be *assured* that the unit is ready for instant use, it is recommended that it be set up and operated *at least once each week.*

☆

NOTES

NOTES

JOHNSON

MODEL P-500 PUMP

SECTION IV

DESCRIPTION AND OPERATION OF COMPONENT UNITS

Trouble Shooting

DIAGNOSIS

The First Class Machinist's Mate laid his first shot smack on the target when he said, "It aint the fixin' that's so hard, it's findin' out just what needs fixin.' "

Finding (and fixing) trouble requires two things:

1. Knowledge of the Fundamental Principles of operation.
2. Systematic Search.

Diagnosis (determining just what the trouble is) always precedes the actual job of repair. There is a knack to it which can be acquired by careful, extended study. It is most important.

THE THREE FUNDAMENTALS

(Of gasoline engine operation)

All gasoline engines operate on the basis of three fundamentals. If these three fundamentals are fulfilled, the engine is bound to run, barring minor mechanical difficulties.

1. A correct mixture of fuel and air.
2. Good compression of the fuel and air mixture.
3. A hot spark, properly timed, to ignite the compressed mixture of fuel and air.

Fundamental No. 1 requires that the gasoline fuel be of good quality; that this fuel reach the carburetor bowl without stoppage (valves open, no dirt in line); that it be drawn through the carburetor jets; that the carburetor proportion the fuel to the amount of air drawn through; and that the mixture enter the engine from the carburetor without undue restriction.

Fundamental No. 2 requires that this mixture, after it has reached the engine (the crankcase, first, in this two-cycle engine) be compressed in the cylinder. This means good pistons, good cylinder bores, good piston rings, and good lubrication—without gasket or other leaks.

Fundamental No. 3 requires that when the mixture has been compressed, that then a hot electric spark jump the spark plug gap *at the right time* to ignite the compressed mixture and start its combustion. This means a magneto that produces a high tension electric current, properly timed; good high tension leads (wires) to carry this current to the spark plugs without permitting leakage or short-circuits; and spark plugs that are clean, with properly adjusted gaps, and that do not allow the current to leak or short-circuit. The spark must be "advanced" for higher power and speed, "retarded" for lower power and speed. Otherwise, the timing is fixed—built in—by the construction of the magneto in the flywheel.

One of the "mechanical difficulties" which may prevent engine operation and the development of power is the rubbing of metal on metal—*lack of lubrication.* It is obvious that bearings, cylinder walls, pistons, etc., must be lubricated to function. Lubrication is fully and completely provided for by the oil which is mixed thoroughly with the gasoline (in the proportion of one pint of oil to each gallon of gasoline).

Trouble Chart

IF ENGINE FAILS TO START

1. FUEL TANKS must be full of proper gasoline and oil mixture.
2. VALVES on fuel tanks and on panel to be OPEN.
3. PRIME CARBURETOR two to four times and gasoline should run out end of drain pipe leading from carburetor.
4. FLOAT PIN or panel should be up. Touch float pin to make sure it is floating and not resting on bottom of bowl.

   NOTE:—If float is up and no gasoline can be primed into carburetor, see Section V on cleaning of carburetor.

   If float pin is down, which indicates no gasoline in carburetor, see Section V for cleaning fuel lines.
5. SPARK PLUGS should be replaced.
6. MAGNETO can be checked by removing *one* lead from a spark plug and holding it about 3/16″ from a corner of a cylinder head nut. A second person should pull starter rope as for starting. Repeat the operation for the other lead on the same side of the engine. If no spark or a weak spark shows, clean magneto points and adjust to .020″ if necessary as shown in

Section V. If cleaning the points does no good, the magneto should be repaired according to Section V.

7. FLOODED condition in engine caused by excessive priming may be the cause of hard starting. In this case, do not prime but continue to pull motor over with starter rope as in starting, until it works out the flood. In extreme cases it may be necessary to remove all spark plugs, GROUND ALL SPARK LEADS, and continue to crank the engine for 10 to 15 pulls. Put in new spark plugs and pull starter rope until it starts.
8. LEAN MIXTURE caused by not enough priming in COLD WEATHER may keep an engine from starting. The primer is set for average conditions, using aviation gasoline. If low grade fuel is used in cold weather, a larger amount of priming MAY be necessary.
9. LEADS TO SPARK PLUGS may be reversed. Each lead has its proper marking, so no trouble should be experienced in correcting this fault.
10. ENGINE IN BAD CONDITION due to long period of operation may be a cause of hard starting. Excessive carbon deposits in exhaust ports, and piston rings stuck will cause this trouble. See Section V for repairing motor after extended operations.
11. EXHAUST HOSE plugged due to lining of hose becoming loose and closing passage. Replace with new hose. Due to oil in exhaust gases a synthetic rubber 2½" suction hose is best. NEVER USE PRESSURE TYPE HOSE ON THE EXHAUST AS IT WILL FLATTEN AND RESTRICT GASES.
12. WATER TRAP in exhaust hose. Exhaust hose should always slope continuously upward from pump or continuously downward so no water pockets will form in the hose. *THIS IS IMPORTANT.*
13. GASOLINE AND OIL improperly mixed so oil has settled to bottom of the tank around the outlet. To correct, remove tank and shake violently. Open tank valve to spill out small amount of fuel to be sure there is no more oil around outlet. Connect tank. Press float pin until oil in carburetor is washed out. Press carburetor primer and start engine.

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Spark Plugs

Engine is equipped with Champion R-1 spark plugs.

FOULING—It is possible that spark plugs may foul when operating the unit for long periods at part throttle (slow engine speeds) as in the case when the water outlets are shut off—either at the "Y" valve or at the nozzle.

SHORTING—This condition is caused by pieces of carbon breaking loose inside of engine and lodging in spark plug gap or adhering to porcelain to short spark from center wire to shell.

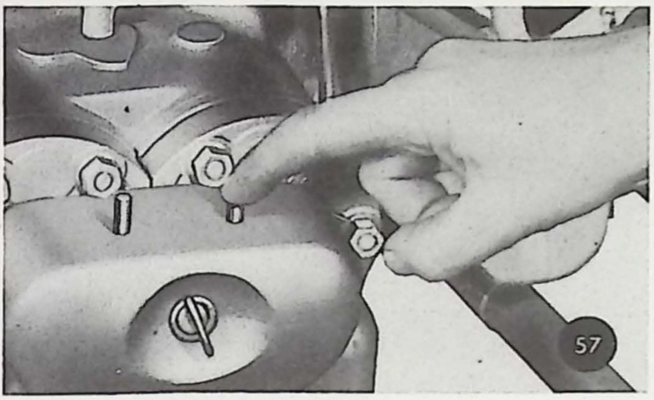


Fig. 57—Shorting Spark Plug

PREFIRING—is caused by carbon breaking loose in engine and adhering to center wire or porcelain. These bits of carbon glow to almost white heat and cause prefiring—generally these bits of carbon burn off and engine runs normal again. However, if prefiring continues, spark plug must be removed and cleaned or replaced. The defective spark plug can generally be found by shorting the spark plugs with spark plug push buttons, Fig. 57.

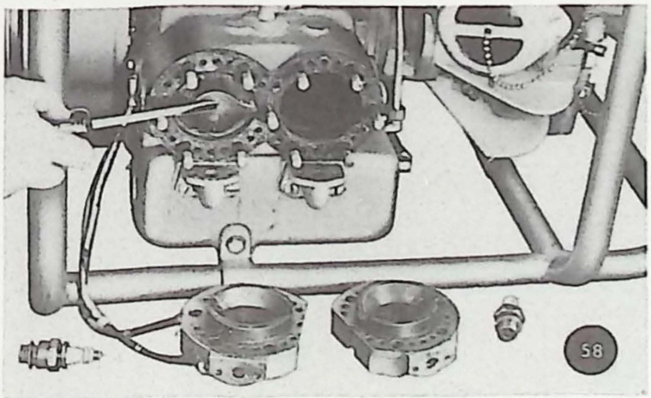


Fig. 58—Scraping Carbon from Piston Head

CARBON REMOVAL—If spark plug life becomes too short, remove cylinder heads—scrape carbon from the cylinder head, piston head and push carbon out of exhaust ports with a blunt rod (*caution*—if the edges of ports are burred, then remove burrs before pistons are moved in cylinder).

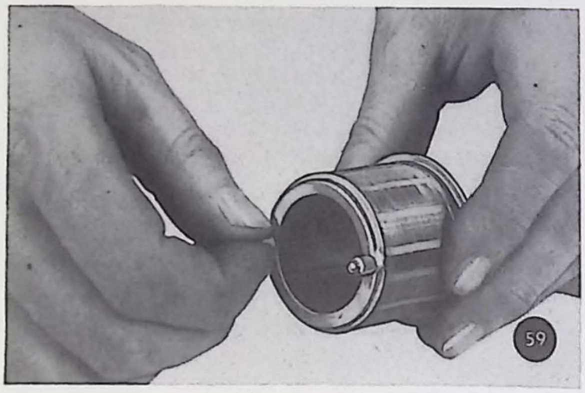
In general, the higher the Tetra Ethyl Lead content of the gasoline the more spark plug difficulty is experienced.

Under ordinary conditions, carbon should be removed after approximately fifty (50) hours of Operation. Fig. 58.

To Clean Fuel Filter

Loosen thumb nut, swing bail to one side and remove metal bowl.

Remove strainer element and gasket from fuel bowl.



Loosen Nuts to Clean Filtering Element

Loosen strainer element plate retainer nuts by three or four turns. Fig. 59.

DO NOT DISASSEMBLE STRAINER PLATES.

Swish the strainer element in alcohol (if available) or kerosene or other solvent to remove dirt and gum.

When available facilities permit, blow compressed air through the holes at top of strainer element. DO NOT APPLY COMPRESSED AIR TO SIDES OF STRAINER ELEMENT PLATES.

Tighten strainer element plate retainer nuts and reinstall strainer in bowl. Always use new bowl gasket if made of cork. In an emergency cork gasket can be turned upside down.

Due to restricted operation or extended usage without cleaning, an occasional strainer element may be encountered which has clogged due to a gum formation from the fuel. Most types of gum deposits are insoluble in ordinary solvents; use alcohol.

When ordinary cleaning, as outlined above, does not result in adequate fuel passage then the strainer element must be replaced. Never completely disassemble a strainer element in an effort to clean the individual plates by scraping or scrubbing. This method always results in bent plates which will destroy the strainer efficiency.

IF ENGINE STARTS BUT SLOWS OR STOPS

1. ADDITIONAL PRIMING OF CARBURETOR may be necessary immediately after starting. Sometimes a second person may be necessary to give a quick prime after engine starts to run, especially in cold weather.
2. NEEDLE VALVE—HIGH SPEED set too lean. Should be opened about ¾ turn from closed position and then re-set when engine is fully operating.
3. FLOAT PIN may drop down after short period of operation due to fuel valve not full open, dirty fuel filter or clogged gasoline lines.
4. NEEDLE VALVE—SLOW SPEED may be set too lean. The normal average setting is one turn open from closed position. It should be properly set by operating the engine for a short time with the pump not primed. (Watch temperature gage so as not to get into "red range.")

   It is also possible to set slow speed needle by operating pump in the usual manner and then close throttle by hand. Slow speed needle valve can then be properly adjusted with a screw driver.

IF ENGINE STARTS
BUT PUMP DOES NOT BUILD UP PRESSURE

1. PUMP NOT PRIMED completely. This can be caused by leaking gaskets on suction hose or leaking foot valve. See Section V for repair to foot valve and Section V on testing of gaskets for leaks.

   NOTE:—If lifting 16 ft. or less, a few strokes on the hand primer while engine is still run.

ning will complete the priming of the pump. If the eductor is in use and suction lift over 16 ft., the engine should be stopped to complete the priming of the pump by bucket method. (Foot Valve must hold water.)

2. FOOT VALVE on end of suction hose not submerged all the time. If the foot valve is above the water only a second it will suck in air and the pump will lose prime and the engine will speed up and then slow down. It is then necessary to reprime.
3. LEAK IN OPERATING CYLINDER will prevent engine from speeding up and, therefore, pressure will not build up. Water leak will drain to the outside at point shown in illustration 21. Replace leaking cylinder. See page 59.
4. STARTING SPEED not high enough to build up minimum pressure to start throttle to open. The throttle is set to operate the engine at 3000 R.P.M. when pump is fully primed, and 4000 R.P.M. when pump is dry. Speed corrections can be made by referring to page 59.

   Spark starts to advance and throttle starts to open at 20 lbs. per sq. in. and should be completely advanced and open at 35 lbs. per sq. in.
5. Y-VALVE OPEN. If the Y-valve is open, there may not be enough restriction to cause enough pressure to build up to operate the control system. Close Y-valve until pressure builds up and then *SLOWLY* open.
6. PRESSURE REGULATOR VALVE may be defective, damaged, or worn out. This is remote and not likely to occur.
7. ORIFICE IN CHECK VALVE may be plugged. See Figure 22.
8. SCREEN IN Y-VALVE for water supply to pressure regulator may be clogged. Clean screen. See Figure 22.

   NOTE:—Items 7 and 8 can be checked by removing line from operating cylinder to see if a good supply of water passes through the passage. If there is a good flow, replace line and check elsewhere.
9. MAGNETO armature plate may be stuck or corroded on its pilot. Remove operating cylinder linkage and test for ease of movement. It should be very free.
10. THROTTLE VALVE SET SCREW may be loose, or throttle improperly adjusted to control linkage. See pages 83-84.
11. THREAD PROTECTOR ON EXHAUST OUTLET (not removed) causing excessive back pressure in exhaust system.

PRESSURE REGULATOR ALLOWS PRESSURE TO GO TOO HIGH

1. ORIFICE CHECK VALVE left out. See Figure 22.
2. DIAPHRAGM in pressure regulator broken. If the upper diaphragm is broken, water will come out the drain hole in the upper housing. See Section V on repair of pressure regulator.
3. PRESSURE LINE from Y-valve to gage to pressure regulator plugged. See Section V for cleaning instructions.

LOSS OF WATER OUTPUT

1. SPARK PLUGS may need replacing. Put in complete new set. To test for shorted or fouled plugs, press button on spark plug cover. See Fig. 57.
2. ENGINE may have considerable total hours of operation with the usual carbon deposits in the exhaust ports, cylinder heads, piston, etc. See Fig. 58 for cleaning carbon. Piston rings may be stuck. See Section V on replacing of piston rings.
3. SPARK AND THROTTLE not fully advanced and open. This can be determined by looking at marks on side of magneto plate (see illustration). At full throttle the lower mark should line up with marker. See pages 59-60 for proper setting. See items No. 3, 6, 8 and 9 on Trouble Chart "If engine starts but does not build up pressure." Same causes would apply here.
4. STRAINER on end of suction hose may be clogged with debris.
5. MAGNETO may need repair. Pages 56-64.
6. SEAL RINGS may need replacing due to wear, particularly when pumping water having excessive sand or grit. Normal replacement should not be necessary unless the clearance on the big seal rings is more than .040 inch on the diameter. Normal new clearance is .014 inch. See Section V for replacement of seal rings.

7. EXHAUST HOSE PLUGGED due to loose hose lining.
8. INTAKE HOSE PLUGGED due to loose hose lining.
9. THREAD PROTECTOR ON EXHAUST OUTLET causing excessive back pressure in exhaust system.
10. CYLINDERS, CRANKSHAFT AND BEARINGS in bad condition due to rusting in storage.
11. CYLINDER HEAD GASKET leak.
12. NEEDLE VALVE not properly set.
13. FUEL:—OIL not in proper amount or not completely mixed.

TEMPERATURE OF ENGINE TOO HIGH

1. THERMOMETER may be damaged. Feel cylinders and return water lines with the bare hands. The temperature should be no more than warm. In feeling the cylinder, care must be taken to feel between the outlet elbow in the cylinder and the cylinder head. The part nearer the crankcase is a transfer port and may be considerably warmer than tolerable on bare hands.
2. WATER SUPPLY line between pump and muffler may be clogged.
3. GASKET ON CYLINDER HEAD may be blown, causing the water to be blown out of the jacket. Remove cylinder heads and replace gasket.

PUMP IS DIFFICULT TO PRIME WITH HAND PRIMER

1. LEAKS IN Y-VALVE.

   LEAKS IN SUCTION HOSE AND GASKETS.

   LEAKS IN CHECK VALVE in line from pump to receiver.

   LEAKS IN CARBON SEAL.

   LEAKS IN ENGINE GASKET in some part connecting with the water passages.

   LEAKS IN PRIMING OPENING in top of pump housing.
2. PUMP OVER 16 FT. ABOVE WATER. Where lift is over 16 ft., the eductor should be used and the "bucket method" of priming employed. (Foot Valve must not leak.)
3. DRAIN PLUG in muffler left out. This plug should not be removed except for special cases and then promptly replaced.
4. CUP WASHER in hand primer damaged or worn out. If new cup washer is not available, remove cap on hand primer and pour in about one pint of water.
5. BROKEN WATER LINE. Check all water connections for broken tubing or loose connections.

ENGINE HARD TO CRANK

1. CYLINDERS RUSTED due to improper preparation for storage, or water leaks into cylinder, or water taken through carburetor and allowed to stand in that condition.
2. SEAL RINGS CORRODED caused by standing for prolonged periods with pump housing full of water.
3. CRANKSHAFT RUSTED due to improper preparation for storage or water taken in through carburetor and allowed to stand in that condition.
4. BROKEN PART caused damage inside engine.

TROUBLES MAY ARISE FROM—

1. Pumping Sandy Water
   a. Wear may occur in
      1. Pump Housing.
      2. Pump Seals.
      3. Impeller.
      4. Y-valves.
   b. Clogging up may occur in
      1. Engine Cylinder Cooling Jackets.
      2. Muffler cooling jackets.
      3. Cooling water pipes.
      4. Regulator and Control Cylinder piping system—especially Check Valve Orifice.
      5. Regulator.
   c. Foot valve leakage—dirt on valve seat.
2. Pumping Water containing Debris
   a. Clogging up may occur in
      1. Suction Strainer—or Valve.
      2. Pipe from Y-valve to Regulator or screen in Y-valve.
      3. Cooling water pipe system.
      4. Cylinder and muffler jackets.
3. Salt Water Corrosion
   a. Magneto Contact Points—clean.

b. High Tension Leads—salt deposit may short-circuit—coat with castor or lubricating oil.

c. Spark Plugs—salt deposit on insulator (outer end) may short-circuit—coat with castor oil or lubricating oil.

d. Y-valves—may stick or abrade—oil.

e. All water pipes—may eventually clog up or cause deterioration at connections.

4. Water or Dirt in Fuel
   a. IMPORTANT! May clog up screens, small passages. May erode pistons and cylinders. May short-circuit gap in spark plugs.

COLD WEATHER OPERATION—Freezing

The Johnson Model P-500 Pump should always be stored where temperatures are above freezing. "Dead End" pipes lead from the Y-valve body to the Regulator, thence to the Control Cylinder, and also to the Water Pressure Gage. Unless the Muffler jackets were previously drained, there is water there too. If this water congeals from low temperature, the component units mentioned cannot function.

When the Unit is taken from above-freezing temperature to below-freezing temperature for operation, a tarpaulin may be thrown over the whole unit as it is operating and this should prevent freezing in any pipes—the Receiver emits considerable heat.

After discontinuing operation, the Unit should be moved to above-freezing temperatures as soon as possible.

DRAINING WATER FROM UNIT— (to Lay Away)

1. After all hoses have been disconnected
   a. Stand the Unit on end—pump end—of frame and allow to stand until no more water drains out. OPEN Y-VALVES.
   b. If considered necessary to drain Muffler jackets
      1. Remove plug from side of muffler (under flywheel) and tip Unit so opening is down—and allow to drain.
         a. BE SURE that drain plug is replaced TIGHT at once as otherwise water will leak out in operation and AIR WILL LEAK IN TO PREVENT PRIMING.
2. Muffler
   a. If the Receiver Float Valve should stick or become stopped up, the Receiver might fill with water and this could run back into the Muffler (not the Muffler jackets). To drain the Muffler (inside)
      1. Remove one of the pipe-plugs in the bottom of the muffler.
         a. BE SURE it is tightly replaced.

JOHNSON

MODEL P-500 PUMP

SECTION V

DESCRIPTION AND OPERATION OF COMPONENT UNITS

INDEX—SECTION V

Page No.

Ball bearings, crankshaft—remove and install.. 76
Bearing—magneto end of crankshaft—remove. 77
Bearing race, center head—remove and install. 78
Breaker points—adjust 57
Breaker points—clean 57
Breaker points—install 60
Bushings, "Y" valve—replace 87
Carbon Removal 47
Carbon seal, crankcase head—remove
    and install 81
Carbon seal (pump housing)—install 66
Carbon seal (pump housing)—remove 65
Carburetor—adjust 83
Carburetor—remove 82
Center head, crankshaft—install 78
Condenser—install 61
Connecting rod—remove and install 73
Crankshaft—remove 75
Crankshaft key—remove and install 74
Cupwasher, hand primer—install 86
Cylinder blocks—remove and install 70
Cylinder bore—caliper 91
Diaphragms, pressure regulator—install 87
Float, carburetor—install 85
Float valve, carburetor—install 85

Page No.

Flywheel—install 63
Flywheel puller 57
Flywheel—remove 58
Ignition coil—install 63
Impeller—remove and install 64
Inspection 88
Jets, carburetor—replace 86
Magneto plate—remove and install 59
Muffler—remove and install 68
Order of disassembly 55
Piston—install 71
Piston—remove connecting rod 70
Piston rings—remove and install 71
Piston ring gap—check 73
Piston ring grooves—clean 72
Pressure regulator—remove and install 86
Pump housing—remove and install 65
Safety 68
Safety chain—remove and attach 67
Seal ring--remove and install 66
Shop equipment 54
Spark timing—adjust 59
Throttle clutch, carburetor—assemble 84
"Y" valve—assemble 68
"Y" valve—disassemble 67

COMMENTS ON REPAIRING

This section of the manual is devoted to maintenance of the pump and includes information on such repairs and adjustments as are needed from time to time as the occasions arise. Repairs may involve but minor adjustments in some instances and in others, complete tear-down for major overhaul. In either case, the following instructions should be carefully and thoroughly read prior to proceeding.

When called upon to make repairs, in all probability a description of the difficulty will accompany the unit—but it is possible that instructions may simply read "Repair." When no specific instructions are provided, the first thing to do is to find out "what's wrong." Keep in mind always the three fundamentals necessary to make any gasoline engine run—(1) Gas, (2) Spark, and (3) Compression. See "Trouble Shooting" (operating maintenance), pages 46-47.

Don't tear the unit down until the nature of the difficulty has been well established—there may not be anything wrong with the engine that a few minor adjustments cannot correct. The engine may be perfectly all right—possibly it's only the pumping mechanism that's out of order. Look for air leaks (faulty gaskets and worn seals).

Do the job carefully—observe the order in which parts or assemblies are removed from the unit so that reassembly can be made in the same order—installing whatever new parts are necessary. Don't be too hasty—determine what is to be repaired first, then proceed accordingly.

It is said that "Cleanliness is next to Godliness"—maybe it is and maybe it isn't, but cleanliness, nevertheless, is extremely important when performing repair operations. Never conduct repairs in a dirty, messy shop—be sure the work bench and all tools are kept clean. Wash thoroughly (with gasoline) all parts removed from the unit. Set them aside in an orderly fashion where they will be readily available for assembly. *KEEP BENCH TOP,* ALL TOOLS, *PARTS* AND HANDS CLEAN AND FREE FROM DIRT.

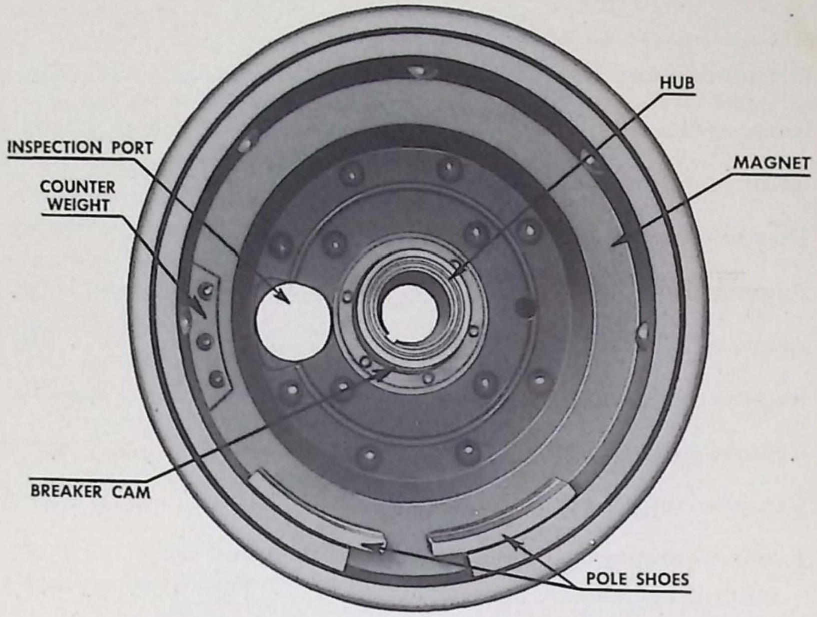
Suggestions for Shop Equipment

1	Work Bench—8 ft. long.
1	4" Vice (Copper or Brass Jaws for same).
1	Arbor Press.
1	Drill Press.
1	Set Drills.
1	Set Taps.
1	One-Pound Hammer.
1	8-oz. Hammer.
1	Rawhide Mallet.
	Telescope Gauges 1/2" to 3".
1	Micrometer Caliper 0" to 1".
1	Micrometer Caliper 1" to 2".
1	Micrometer Caliper 2" to 3".
2	12" Crescent Wrenches.
1	12" T Handle Screw Driver.
1	6" Screw Driver.
1	14" Screw Driver.
1	Set Socket Wrenches—7/16" to 1" (by 1/16" steps).
1	Set End Wrenches—7/16" to 1" (by 1/16" steps).
1	Deep Wall Socket Wrench—7/8".
1	Deep Wall Socket Wrench—1" (For Spark Plugs).
1	6" Pliers.
1	6" Pliers—Long Nose.
1	Oil Can and Oil.
	Cleaning Gasoline.
	Air Pressure for Utility Purposes.

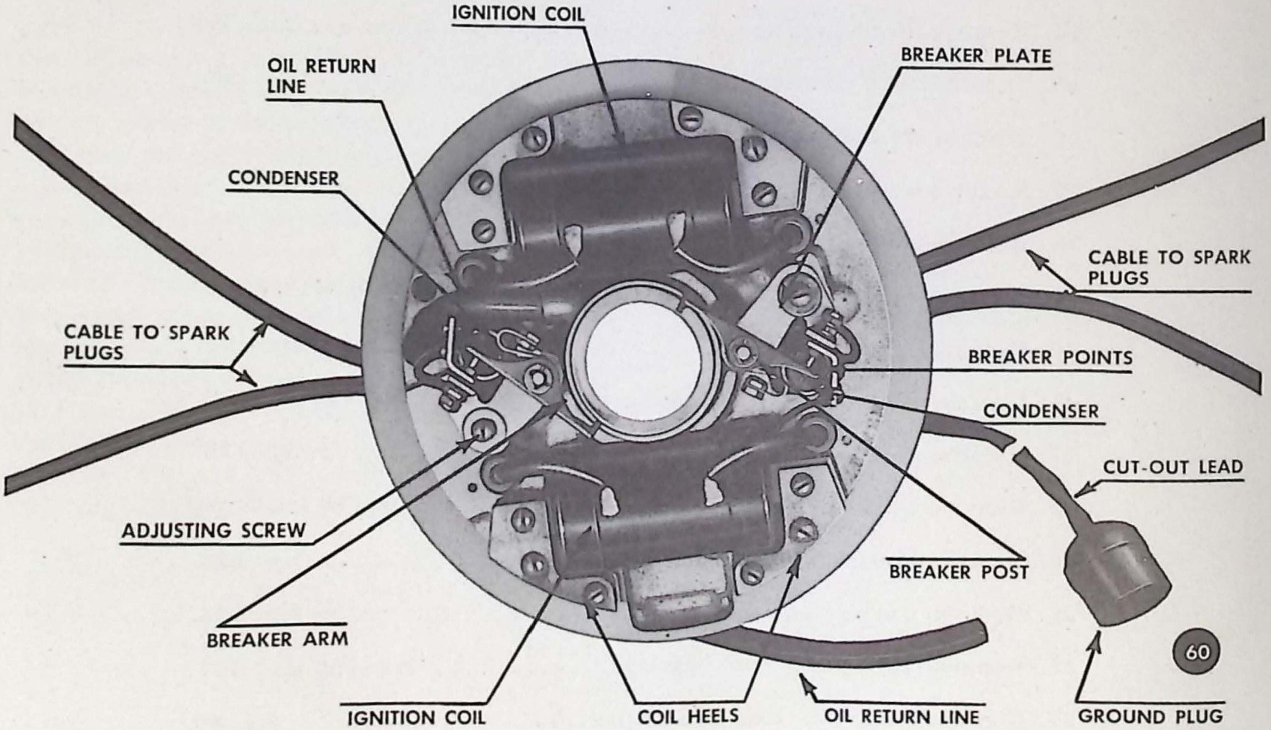
Order of Disassembly

1. Disconnect fuel lines from gas tank.................. Fig. 17.
2. Remove fuel tanks.......................... Figs. 42 and 43.
3. Remove panels.
4. Disconnect and remove all water pipes.
5. Remove hand primer................................ Fig. 6.
6. Remove "Y" valve.................................. Fig. 6.
7. Remove receiver................................... Fig. 4.
8. Remove pump housing head......................... Fig. 83.
9. Unscrew impeller nut and remove impeller........... Page 84.
10. Remove carburetor, fuel filter, pressure regulator and control cylinder..................... Figs. 9, 19, 21 and 23.
11. Detach magneto ground plug....................... Fig. 71.
12. Remove spark plug covers and spark plugs............ Fig. 4.
13. Remove flywheel.......................... Figs. 68 and 69.
14. Remove magneto plate............................ Fig. 73.
15. Detach pump housing from engine.................. Fig. 88.
16. Disconnect and lift engine from frame.
17. Remove water elbows.
18. Remove cylinder heads.
19. Remove muffler.................. Figs. 102, 103, 104 and 105.
20. Remove cylinders................................ Fig. 107.
21. Detach pistons from connecting rods........ Figs. 108 and 109.
22. Remove connecting rods.......................... Fig. 120.
23. Remove crankshaft................ Figs. 123 to 128 inclusive.
24. Remove center crankcase bearing.................. Fig. 129.
25. Remove magneto end bearings...................... Fig. 134.
26. Remove two pump end bearings............ Fig. 130 and 131.
27. Remove pump seal ring if damaged.................. Fig. 89.
28. Remove carbon seals if damaged............. Figs. 90 and 141.

MAGNETO


HUB
INSPECTION PORT
MAGNET
COUNTER WEIGHT
BREAKER CAM
POLE SHOES

Flywheel

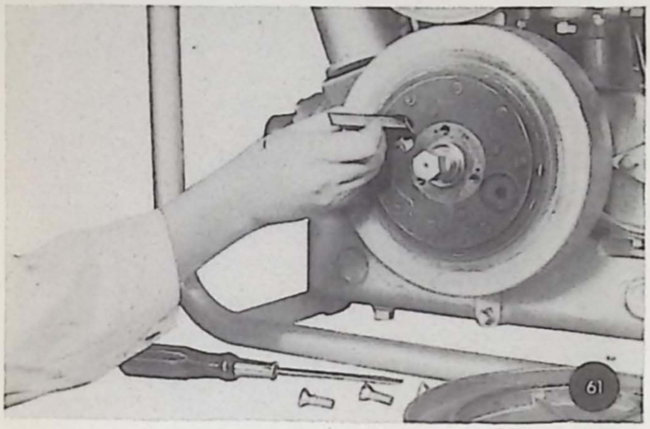

IGNITION COIL
OIL RETURN LINE
BREAKER PLATE
CONDENSER
CABLE TO SPARK PLUGS
CABLE TO SPARK PLUGS
BREAKER POINTS
CONDENSER
CUT-OUT LEAD
ADJUSTING SCREW
BREAKER POST
BREAKER ARM
60
IGNITION COIL
COIL HEELS
OIL RETURN LINE
GROUND PLUG

Magneto Plate

TO CLEAN BREAKER POINTS

Remove starter plate. Note inspection port in flywheel. Turn flywheel to uncover points and to a position where points are open (spread). Install flexible point cleaner between points. Turn flywheel back until points close on cleaner. Clean or dress points by carefully moving back and forth, Fig. 61. Continue operation until point surfaces are clean and smooth. After dressing with cleaner, insert piece of paper between points to remove particles of cleaner which may have lodged on point surfaces. If points are pitted or corroded beyond reconditioning with cleaner, install a new set.

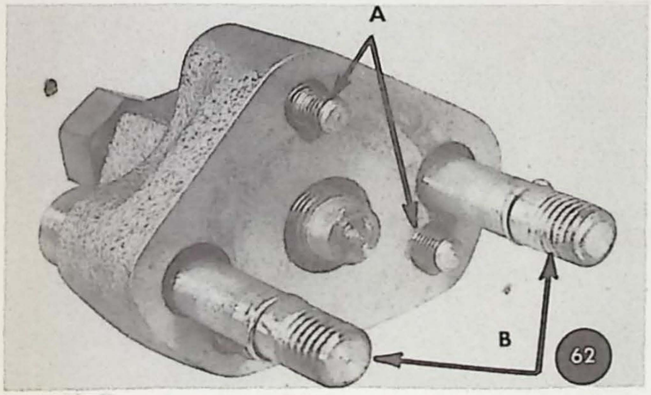
Scrape corrosion, if any, from outside diameter of points so that no loose particles may fall between points.



Cleaning Breaker Points

THE FLYWHEEL-IMPELLER PULLER

This puller is constructed to perform two operations, namely; (1) to remove the flywheel, and (2) to remove the water pump impeller. Note two large and three small cap screws (A and B Fig. 62). Small screws are used when pulling flywheel—large screws for the impeller. A lock ring is provided on each screw to prevent its loss when not in use.



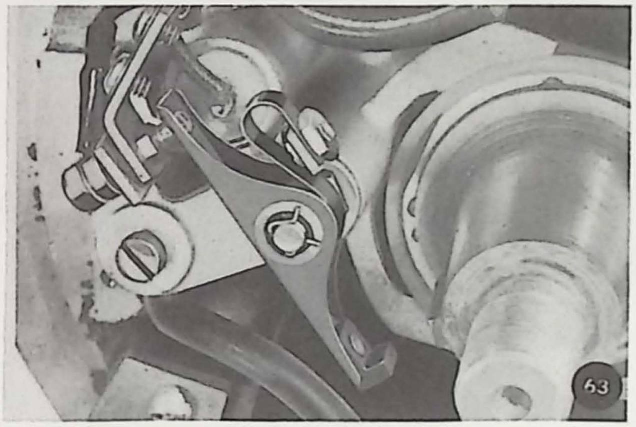
The Flywheel-Impeller Puller

There are spanner wrench hooks on the puller body to be used to prevent the flywheel from turning when removing the impeller first and the flywheel second.

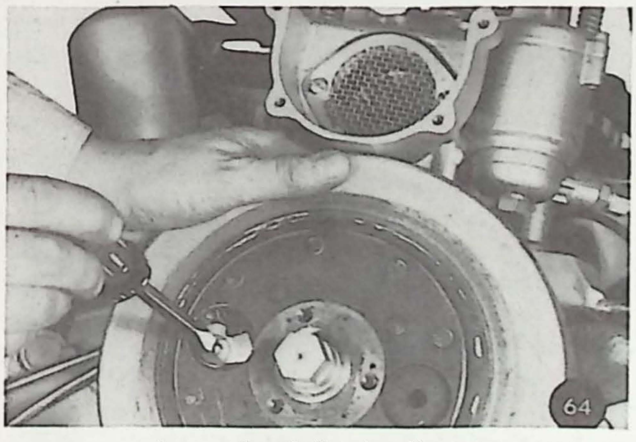
TO ADJUST BREAKER POINT GAP

The correct breaker point gap is .020". (Fig. 63—point assembly as it appears with flywheel removed.) After having removed starter pulley, turn flywheel to expose point assembly and to a position where points are full open—insert feeler gauge (.020") to check gap. If necessary to adjust, loosen adjusting screw (Fig. 64) just enough to permit moving plates. Pry breaker plates up or down as desired to obtain correct gap (.020"). (Fig. 65.) Check with gauge as shown in Fig. 66. Lock in position by tightening screw (Fig. 64).

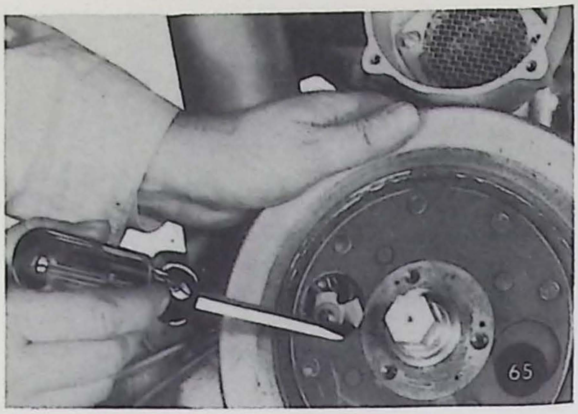
NOTE: Since points are operated by breaker arm rubbing block riding on cam attached to flywheel hub (Fig. 60), point gap is increased by shifting assembly towards hub—decreased by moving away from hub.



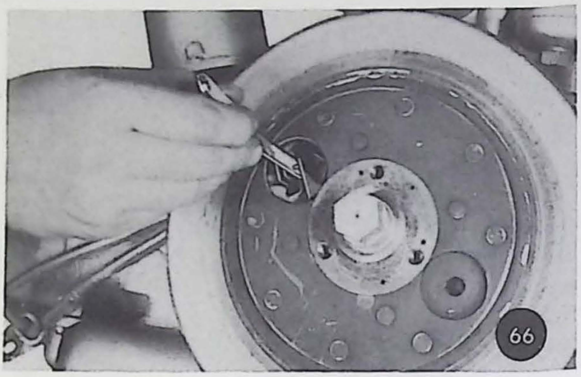
Breaker Points as They Appear under Flywheel



Loosening Adjusting Screw



Moving Breaker Plate (Up or Down)



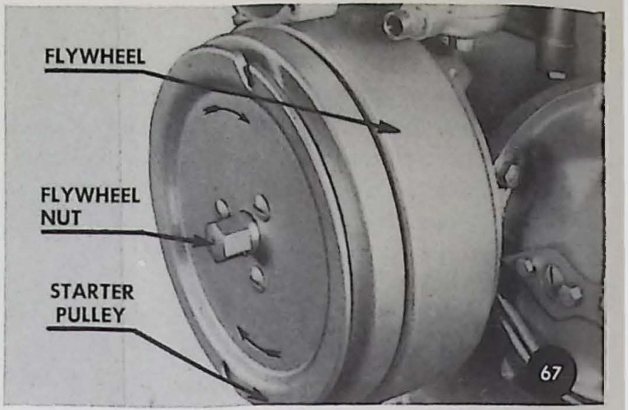
Checking Breaker Point Gap

☆

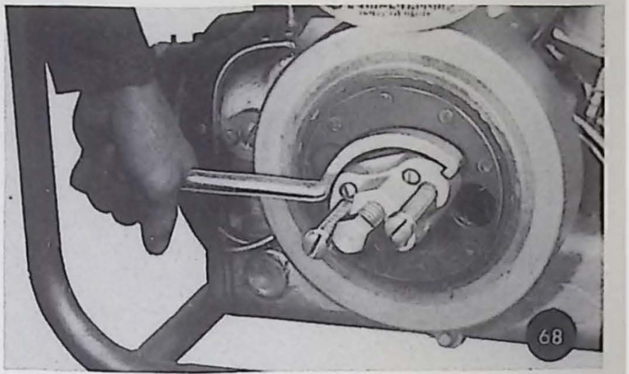
TO REMOVE FLYWHEEL

Remove three screws holding flywheel starter pulley. Lift from flywheel. Remove flywheel nut. Attach flywheel puller (Fig. 62) as shown in Fig. 68. NOTE: Three small screws in puller fit into positions previously occupied by the starter plate screws. Draw screws up just firm. Attach spanner to puller as shown (Fig. 68). Attach wrench to puller screw as in Fig. 69. Pull up on spanner while simultaneously pushing down on wrench handle. Apply pressure until flywheel is pulled free of crankshaft. Lift flywheel from crankshaft—detach puller.

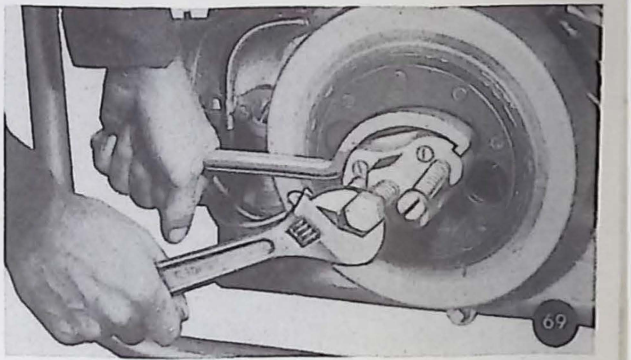
Removed flywheel exposes magneto plate assembly for repair or adjustment (Fig. 70).



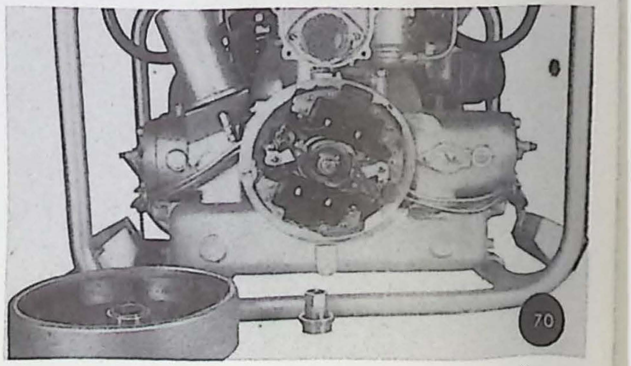
Magneto as Attached to Engine



Applying Spanner to Flywheel Puller



Pulling Flywheel



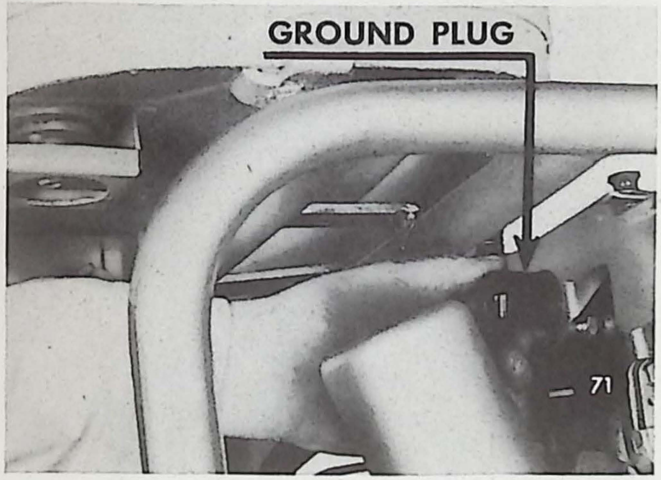
Flywheel Removed to Expose Magneto Plate

REMOVE AND INSTALL MAGNETO PLATE

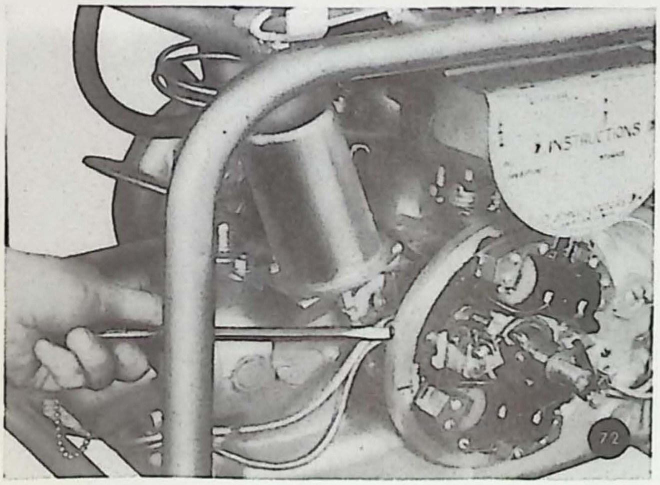
Detach ground plug from control panel (Fig. 71). Remove spark plug covers, held in place by thumb screw. Detach spark plug leads (from spark plugs). Push grommet out of spark plug lead brackets (one on each cylinder block). Pull leads through brackets to free. Disconnect control shaft and carburetor control from magneto plate—loosen tension screw slightly with screw driver (Fig. 72).

Turn magneto plate to right (assembly is held in place by bayonet lock) as in Fig. 73. Carefully work free and remove from boss on crankcase, Fig. 74.

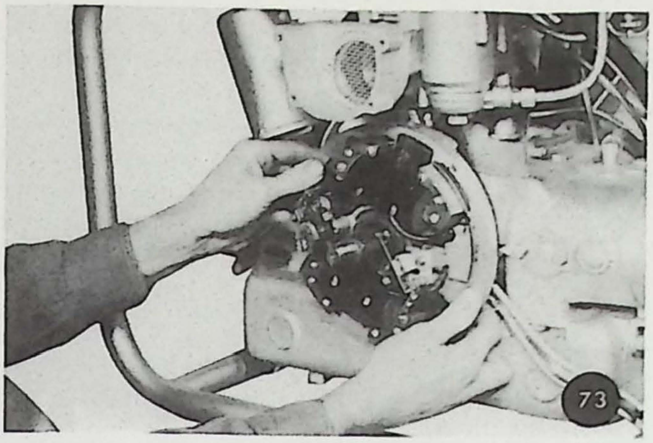
To replace magneto plate, proceed in reverse order of that described above. Be sure crankcase boss is clean—spread thin film of oil on boss surface. Attach magneto plate—connect control and carburetor shafts. Press in lightly and turn to left until it slips into position (held by bayonet lock). Replace high tension leads (spark plug wires) in original positions.



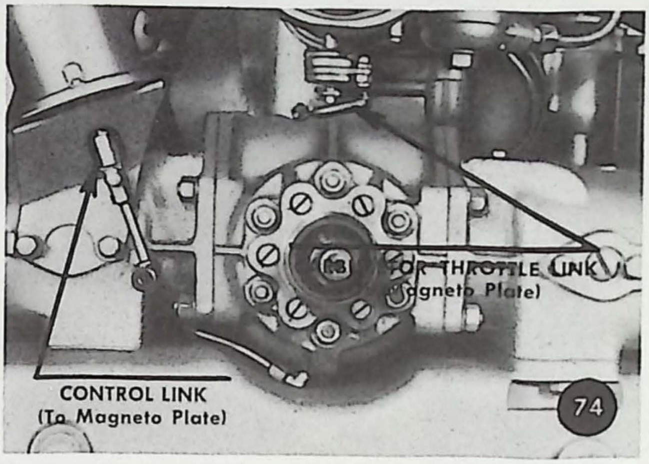
Detaching Ground Plug



Releasing Magneto Plate Tension



Removing Magneto Plate



Magneto Plate Removed

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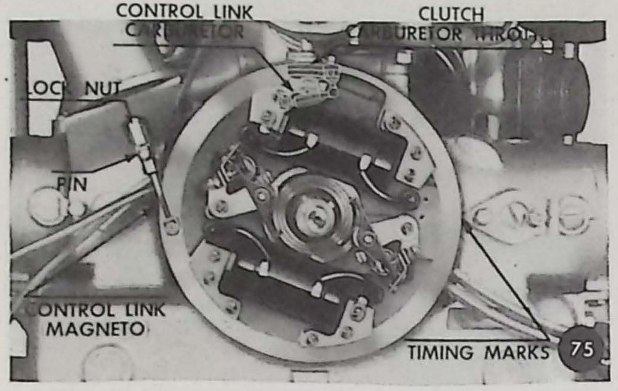
TO ADJUST SPARK TIMING

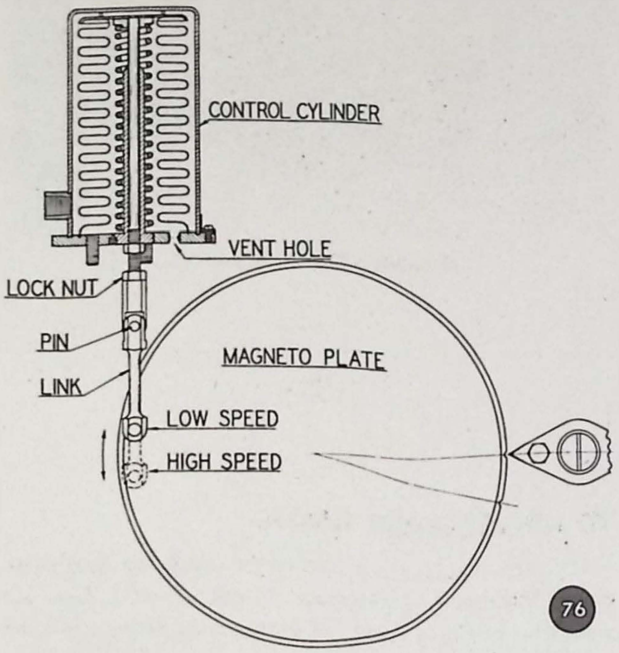
There are two timing marks on edge of magneto plate. Pointer on cylinder block should line up with one of these marks. Upper mark lines up with pointer when motor is not running. See Fig. 77. Lower mark lines up with marker when motor pulls full power. THIS IS IMPORTANT.

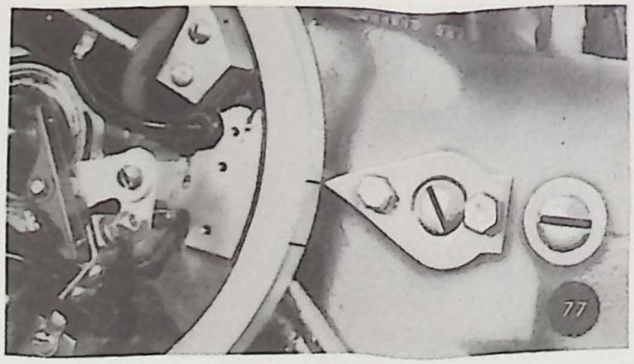
To correct for spark setting, remove link connecting between control cylinder and magneto plate. Screw connector on control cylinder up or down the correct amount and replace link. Check timing.

If timing is correct, remove link again, remove control cylinder to tighten lock nut. Replace control cylinder and link. BE SURE LINK DOES NOT BIND ON EITHER END.

To avoid removal of control cylinder to tighten lock nut on shaft, it is better to apply water or air pressure at the tube connection inlet. This will extend shaft and provide wrench clearance. Pressure should be over 40 pounds per square inch and less than 150 pounds per square inch. Pressure should be applied by removing connecting water tube.


CONTROL LINK
CARBURETOR
CLUTCH
CARBURETOR THROTTLE
LOCK NUT
PIN
CONTROL LINK
MAGNETO
TIMING MARKS
75


CONTROL CYLINDER
VENT HOLE
LOCK NUT
PIN
LINK
MAGNETO PLATE
LOW SPEED
HIGH SPEED
76



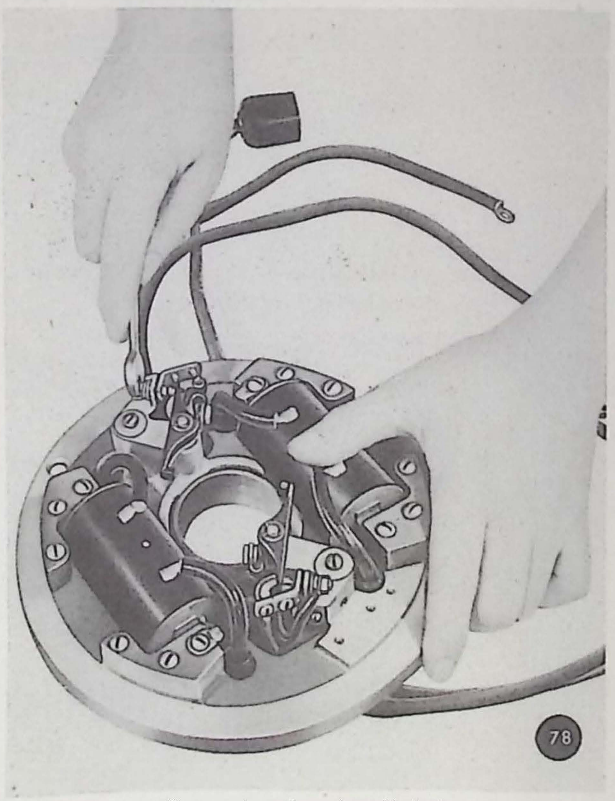
Timing Marks

TO INSTALL NEW BREAKER POINTS

(Breaker Point and Breaker Arm Assembly)

Loosen and remove nut holding breaker arm spring fast to magneto plate (Fig. 78). Remove small clip and washer holding breaker arm on pivot post. Lift breaker arm assembly off pivot post. Remove nuts, washers, and two insulating washers and one insulating bushing holding stationary point in breaker plate. (Fig. 63.)

Install new points in reverse order of that described above. (When making disassembly, observe order in which parts are removed to ascertain that all parts are replaced in their respective positions on reassembly—especially the insulating washers and bushings on the stationary point screw). Be sure breaker arm operates freely on pivot post and that all nuts are drawn up securely to prevent their dropping off when pump is in operation, thus avoiding break-down. THIS IS IMPORTANT. Adjust breaker point gap as instructed above. (Page 57.) NOTE: Flywheel must be installed to adjust points as the cam operating the points is on the flywheel hub (Fig. 60). Care should be taken to see that none of the wires on magneto plate assembly rub against inside of flywheel rim to cause short circuit.

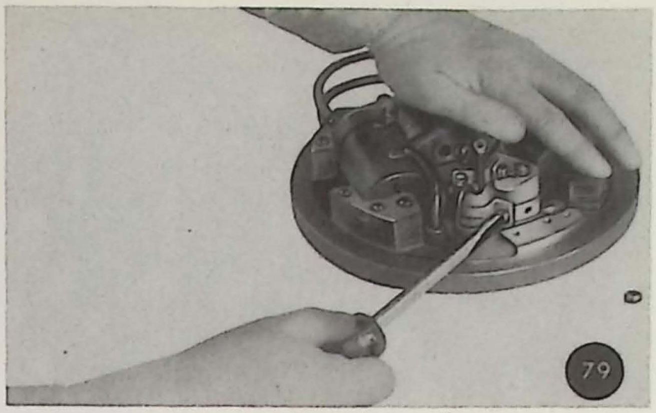


Removing Breaker Points

TO INSTALL NEW CONDENSER

Note position of condenser (Fig. 79) immediately back of breaker point assembly. Detach condenser lead and remove mounting screw. Simply lift condenser from armature plate assembly.

Place new condenser in position, replace mounting screw, attach condenser lead to bracket. Be sure surfaces are clean and bright to make good electrical connection and that screws are tight.



Removing Condenser

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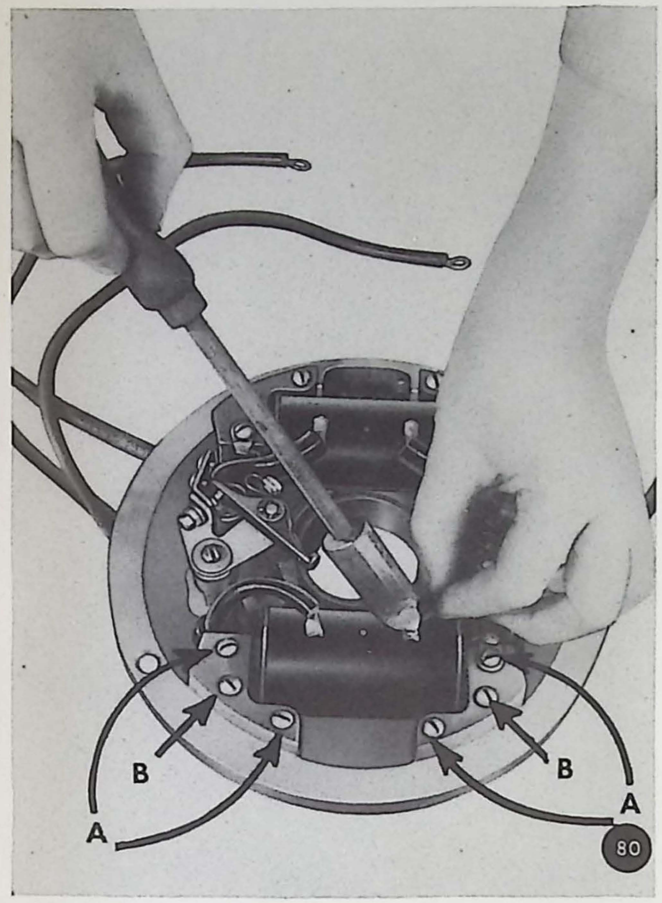
NOTES

NOTES

TO INSTALL NEW IGNITION COIL

Detach primary lead attached to breaker point assembly (Fig. 60). (Primary leads are the small wires leading from coils.) Detach high tension leads (spark plug wire) soldered to coil (Fig. 80). Use small soldering iron and just enough heat to loosen soldered joint to permit pulling wire away.

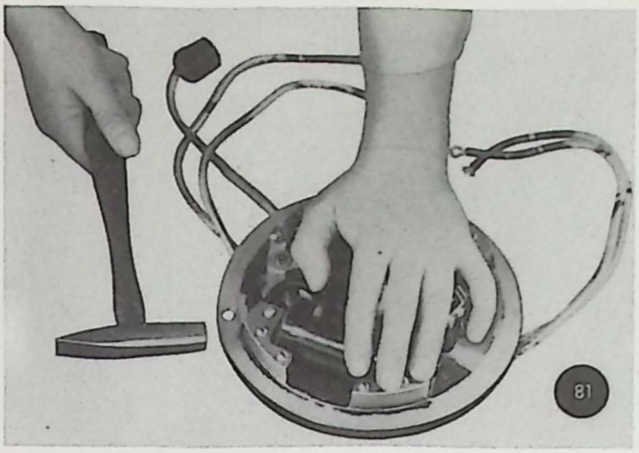


Removing and Installing High Tension Leads

Remove only screws "A" Fig. 80. Lift coil and heel assembly from plate. Purpose of screw "B" is to hold plates of heel assembly together. DO NOT REMOVE THIS SCREW—merely loosen a bit.

Pry heel assembly gently from coil—pull off by hand.

Attach heel assemblies to new coil. Place coil and heel assembly in position on magneto plate. Insert and tighten screws "A," also screw "B." Solder high tension leads (spark plug wires) to coil in their respective position. Use soldering paste or rosin flux. *DO NOT,* UNDER ANY CIRCUMSTANCES, USE AN ACID FLUX. Avoid detrimental effects of corrosion by using only paste or rosin flux. Use just enough heat, solder and flux to obtain a good substantial connection. Application of excessive heat will burn off small secondary lead inside of coil tube. Over use of solder or flux will result in short circuits to render the coil inoperative.



Adjusting Coil Heels

Coil heels must be made flush with boss on magneto plate, Fig. 81, to prevent striking pole shoes of magnet when unit is in operation. This can be accomplished by tapping heel assemblies as illustrated until flush with boss. If a lathe is available, mount magneto plate assembly on mandrel between centers and turn heel surfaces down until flush with boss or 7.218" + .004" diameter. On having completed this operation, further tighten all screws in heel assembly to make certain coil is securely mounted.

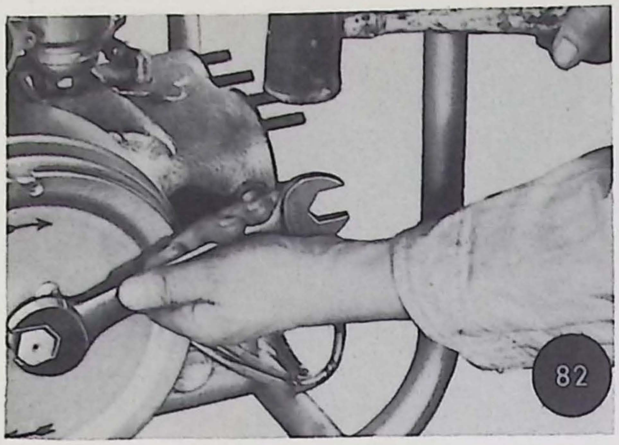
CAUTION: Screws mount in aluminum, threads can be stripped so use care when tightening.

INSTALL FLYWHEEL

Make certain flywheel key is properly seated and tight in crankshaft. Carefully slide flywheel over crankshaft taper—at same time lining up keyway slot in hub of flywheel with key in crankshaft. Press on by hand. Make sure flywheel does not ride on the key—this can be determined by sliding a narrow piece of shim stock (.005" to .010" thick) over top of key. There must be clearance between top of key and bottom of slot in the flywheel.

Attach nut—screw up tightly to drive flywheel on crankshaft securely. The flywheel *MUST* be made tight on the crankshaft. Draw up on nut as far as possible by hand—further tighten by striking handle of wrench several sharp blows with hammer, as in Fig. 82.

Start engine—run five to ten minutes (pumping water), then retighten nut to take up possible slack



Tightening Flywheel Nut

created by newly installed flywheel setting on crankshaft taper. THE FLYWHEEL NUT MUST BE TIGHT to prevent seriously damaging flywheel and crankshaft. THIS IS IMPORTANT.

Replace starter pulley (Fig. 67). Be sure screws are made fast to prevent plate flying off when operating pump.

TO REMOVE AND INSTALL IMPELLER

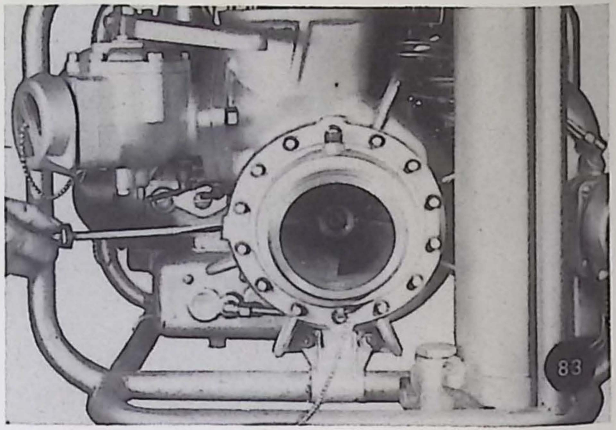
Remove nuts and washers holding pump head to housing—pry cover loose from housing with screw driver. Fig. 83. Note lugs provided for this purpose.

Remove impeller nut. Attach puller to flywheel (Fig. 68) as instructed, Page 58. One man place spanner in position on puller, other apply socket wrench with handle to impeller nut. Man removing nut on impeller pull against man at flywheel end of unit or vice versa. (Nut—right hand thread.) Proceed in like manner to either remove or install impeller nut.

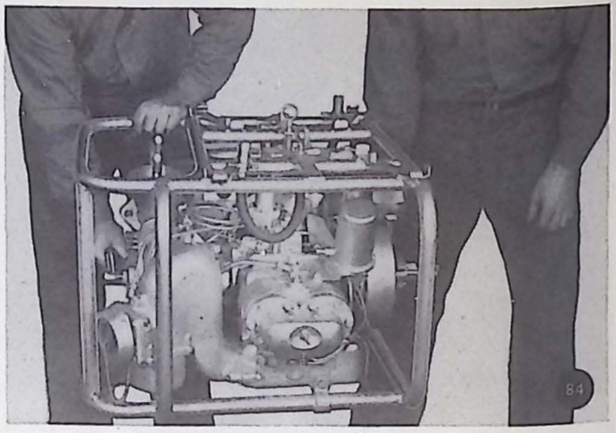
Attach puller to impeller after removing nut. (Fig. 85.) Use the two large screws—screw into impeller just far enough to take good hold, equal amount to square puller with impeller shaft. Place one wrench in position on puller, the other on puller screw (right hand thread). Pull wrenches together (Fig. 86) to exert pressure on crankshaft. Continue in this manner until impeller breaks loose from taper on shaft.

Remove puller. CAUTION: Lay impeller on bench or deck, but with seal surface on taper hub end up to guard against nicking or damage. This surface must be flat and true to prevent water seepage—it is part of the seal. Fig. 87.

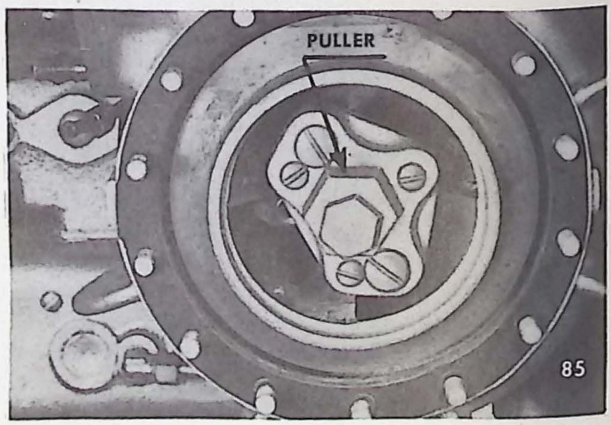
Install impeller in reverse of procedure described. Make certain key is properly located in keyway on crankshaft. Line keyway in impeller with key on shaft. Slide impeller on taper of shaft —be sure keyway in impeller does not ride top of key—use shim stock to check. Replace impeller nut and tighten. NOTE: Use a small punch and force some bronze from impeller hub down into one slot on diameter of nut to lock in place. The seal end of impeller hub should compress the carbon seal from 1/32" to 5/64".



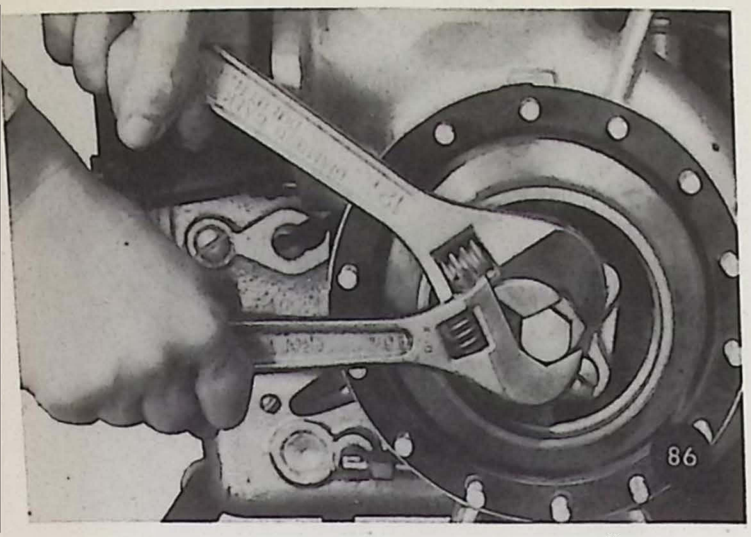
Removing Pump Housing Head



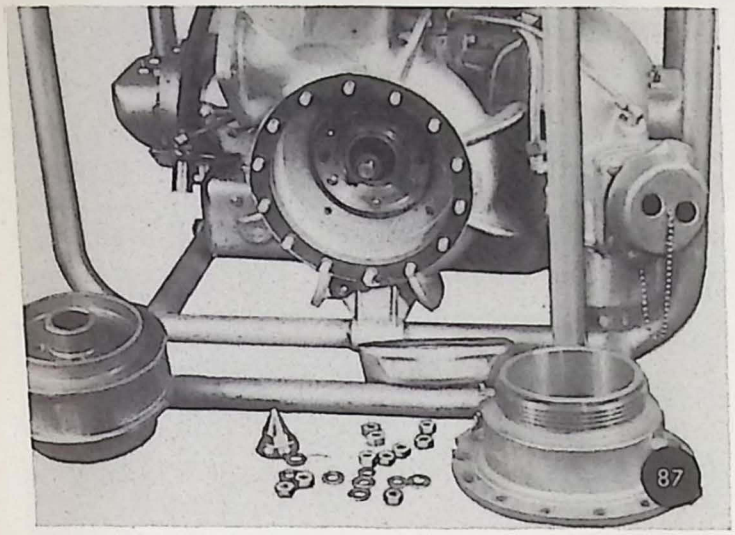
Removing Impeller Nut



Puller Attached to Impeller



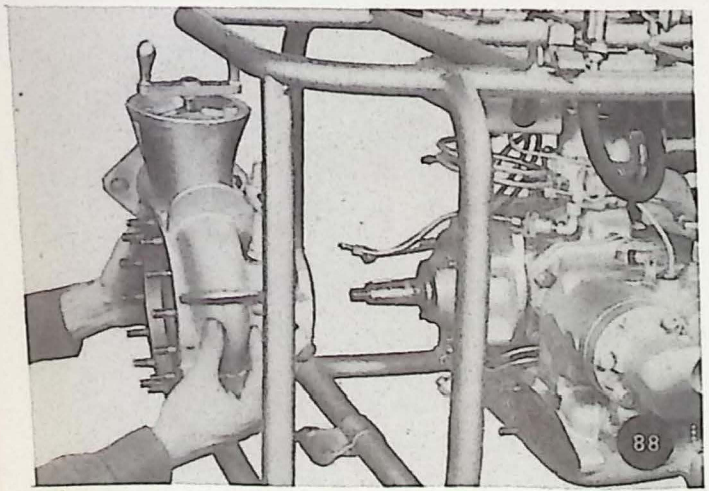
Applying Pressure to Remove Impeller



Impeller and Head Removed

TO REMOVE AND INSTALL PUMP HOUSING

Remove "Y" valve assembly. Remove all water pipes attached to pump housing. Remove water primer and pipes. Remove exhaust receiver and pipes. Put block of wood under rear of motor as illustrated. Remove nuts and washers holding pump housing fast to crankcase head of engine, also bolts attaching it to frame.



Removing and Installing Pump Housing

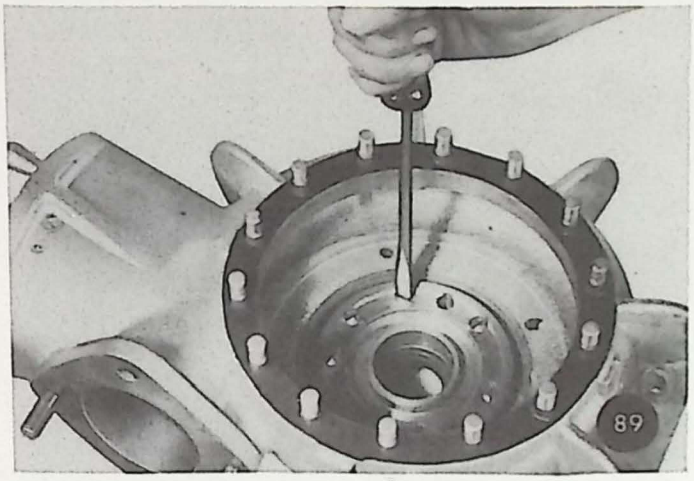
Lift housing carefully from unit. Fig. 88.

Pump housing should be installed in reverse of order described above—set housing in position, attach and tighten crankcase head washer and nuts. Replace bolts mounting housing to frame.

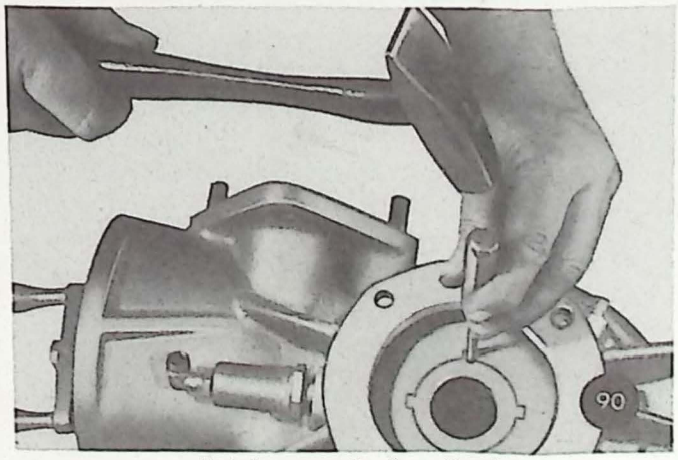
Replace water pipes previously removed. Be sure they are restored to original position.

TO REMOVE CARBON SEAL—
(Pump Housing)

Remove screws holding bronze inner seal ring in pump housing and lift or pry out (Fig. 89). Turn housing over and carefully drive seal out with small punch. Apply driving force only at four notches or locations provided for this purpose, shown in Fig. 90. Drive seal out evenly. Do not permit seal to cock in housing. Extreme care should be taken not to scuff nor scratch side wall of recess retaining seal. If this wall is scratched or scuffed, it may be damaged beyond repair to cause leakage around the seal housing.



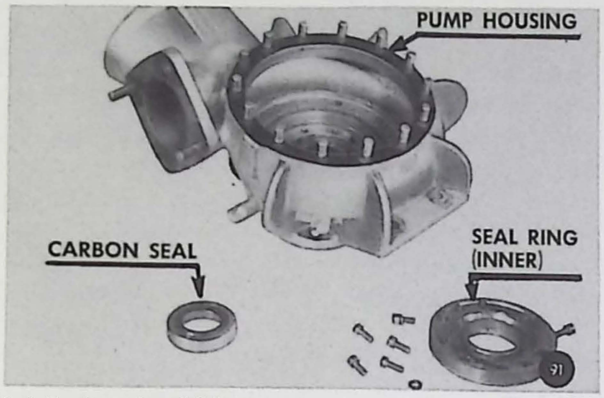
Removing and Installing Bronze Inner Seal Ring



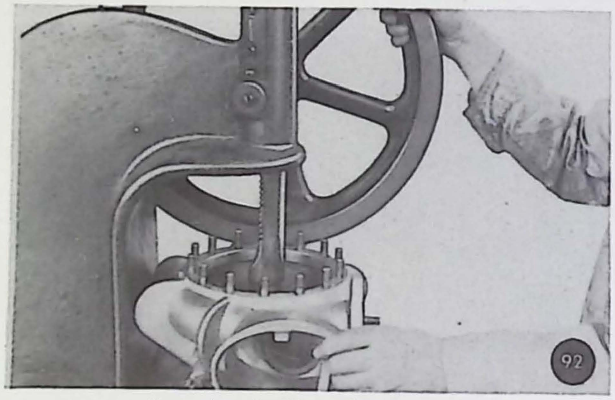
Driving out Carbon Seal

TO INSTALL CARBON SEAL—
(Pump Housing)

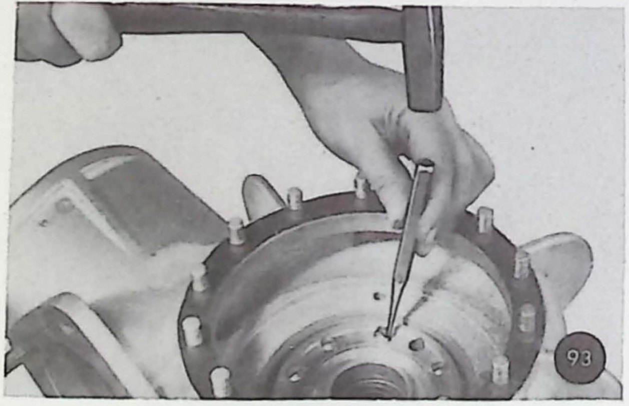
Seal should be carefully pressed into position on an arbor press, applying pressure to the outer diameter of seal housing, Fig. 92. (If press is not available, pump housing can be squarely mounted in a lathe chuck—seal pressed in with tail spindle in similar manner as when using press.) Do not permit seal to cock when pressing in position. Do not chip the carbon in seal as this will render seal useless.



(a) Carbon Seal (b) Inner Seal Ring (c) Pump Housing



Pressing in New Carbon Seal



Upsetting to Secure Screws

Replace bronze inner seal ring. Draw screws up tightly. Lock screws in position to prevent their becoming loose when unit is in operation. Use center punch, Fig. 93. Punch ring close to edge of screw head counterbore and in line with screw slot. Expanding metal will protrude slightly into slot to anchor screw.

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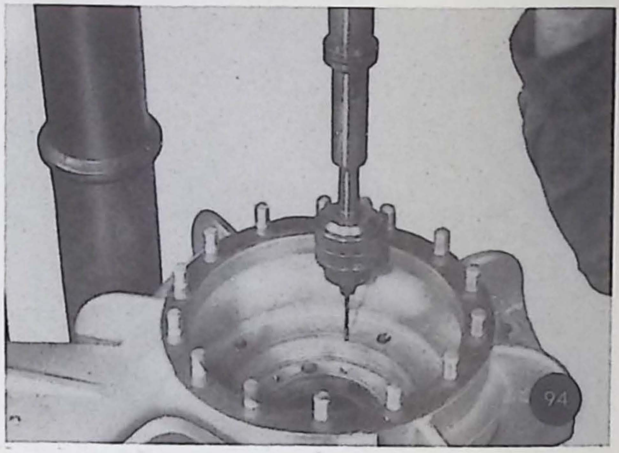
TO REMOVE AND INSTALL SEAL RING IN PUMP HOUSING

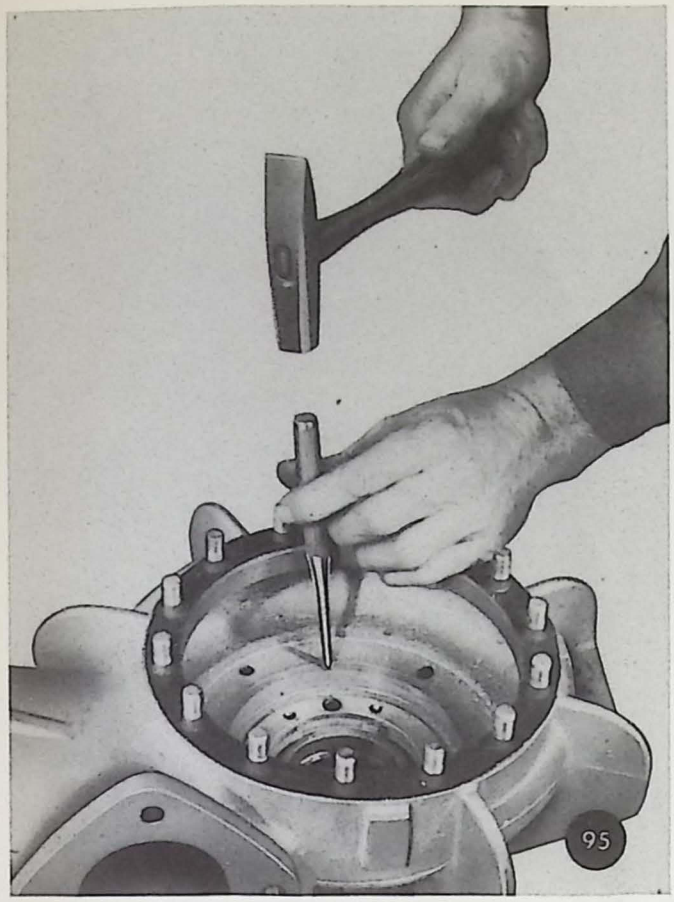
The seal ring is pressed snugly into the pump housing and cannot be very readily removed by pulling or driving out. It can, nevertheless, be collapsed by carefully drilling two 3/32" holes through walls of the ring—being extremely cautious not to drill beyond width of the seal nor into the aluminum housing—Fig. 94. Cut remaining stock (after drilling) out with a diamond point chisel, Fig. 95. This operation should be carefully executed to not damage the casting. Repeat same at other drilled hole—ring should now be broken in two pieces. Lift each piece out.



Drilling Seal Ring

Clean surfaces thoroughly before installing new ring. The ring can either be pressed in on an arbor press or driven in evenly or carefully with hammer and block of hard wood. DO NOT PERMIT RING TO COCK when driving into position.

If a lathe is available, pump housing can be placed in a chuck and the seal bored out.

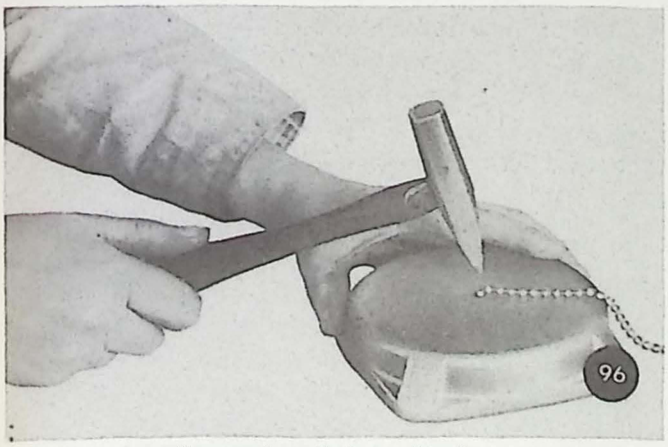


Collapsing Seal Ring to Remove

TO REMOVE AND ATTACH SAFETY CHAINS

It may be found necessary to remove safety chains attached to thread protectors and spark plug covers. In this event simply drive out with hammer as illustrated, Fig. 96. Remove small retainer from end of chain and pull chain out.

To attach chain—insert through hole in cap or plug cover—replace retainer and drive into position.

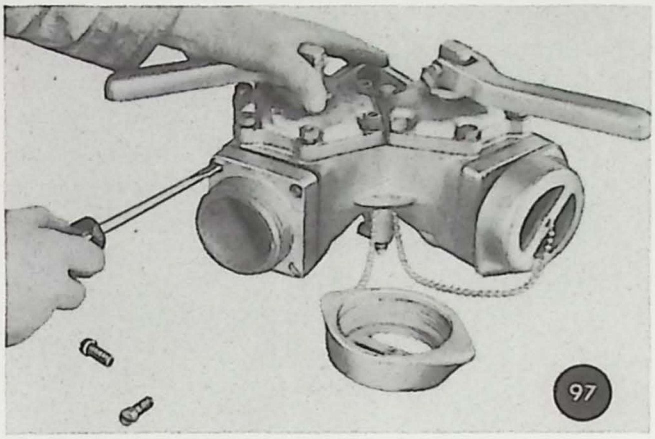


Removing Safety Chains

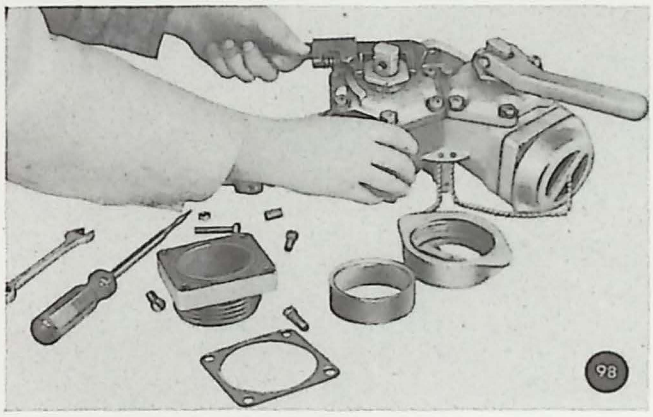
TO DISASSEMBLE "Y" VALVE

First unscrew thread protector after having removed assembly from pump unit.

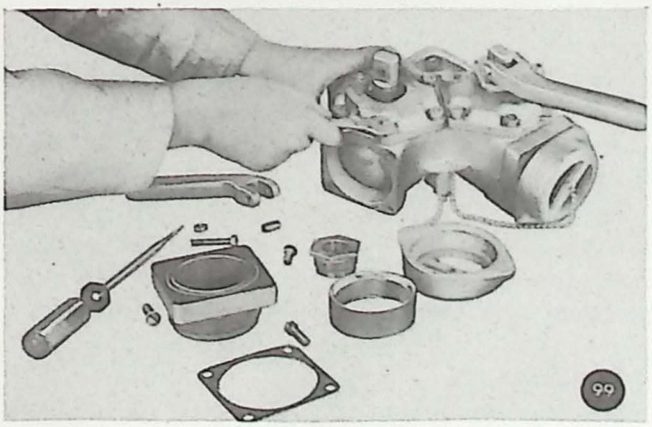
Remove handle from valve stem, held on by bolt and nut and bushing—remove hose connector, Fig. 97, held in position by four screws. Lift Micarta water seal ring from its location in housing. (NOTE: Rubber ring in hose connector, purpose of which is to exert sufficient pressure on the seal ring which bears against the ball valve to provide a water and air tight seat at this point).



Removing Hose Connector



Removing Packing Nut



Removing Valve Cap

Remove packing nut. Fig. 98.

Remove valve cover. Fig. 99.

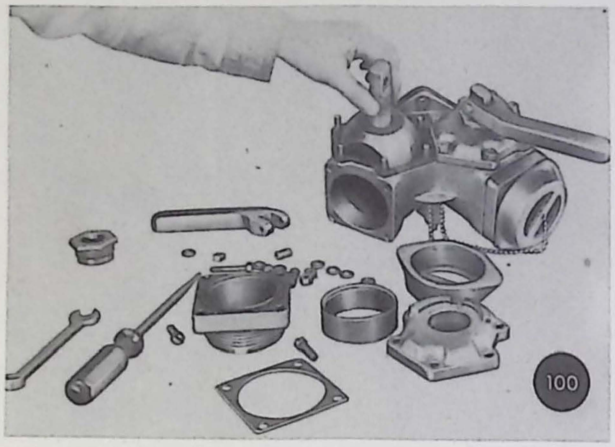
Turn ball valve by hand to "open" position and lift from housing. Fig. 100. (Ball valve cannot be removed unless turned to open position.)

Repeat same operations other valve.

(NOTE: The ball valve may be removed in assembly with ball valve cover, packing nut and handle.)

TO ASSEMBLE VALVE

Wash all parts (except rubber ring in hose connection) in gasoline or kerosene to make certain they are clean and free of grit or other foreign particles. This is IMPORTANT—foreign matter will prevent parts from properly seating in assembly to cause air and water leaks. Pump cannot be primed if air leaks exist. Handle parts carefully—guard against damage to valve sleeve and spherical surfaces of valve. Damage here will cause break in seal (leak).



Removing Ball Valve

Place valve in housing, Fig. 100 (turned to open position). NOTE:—pin in housing and slot in valve—fit pin in slot.

Install valve cover (see that new gasket is provided and that gasket surfaces are clean). Tighten nuts evenly and carefully.

Replace packing nut, Fig. 98.

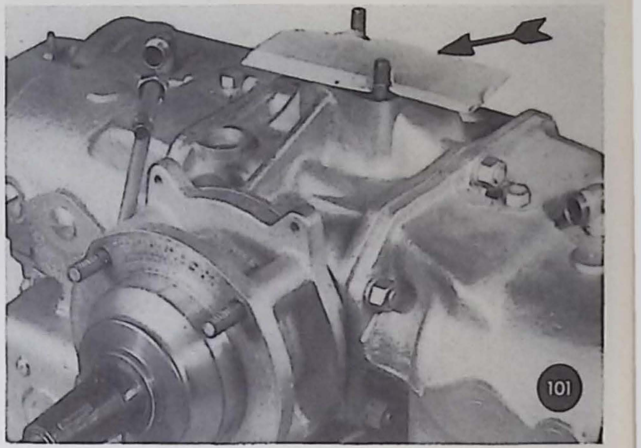
Install valve sleeve. Clean gasket location, install new gasket of proper thickness (1/32") and replace hose connection—(see that rubber ring in hose connection is pliable—live—replace with new one if necessary). Replace and tighten screws.

Attach handle to valve stem.

NOTE:—Small brass bushing must be inserted in valve stem. Do not attempt to turn ball valve, with handle, unless handle is properly bolted to ball valve stem, as this would break the jaws off handle.

SAFETY

To guard against objects (nuts, washers, etc.) dropping into crankcase after removing carburetor and manifold, it is advisable to place something over opening in crankcase. A piece of cardboard of sufficient width to bind between the studs will do as shown in Fig. 101. Keep it there until ready to attach carburetor.



Installing Cylinder Block

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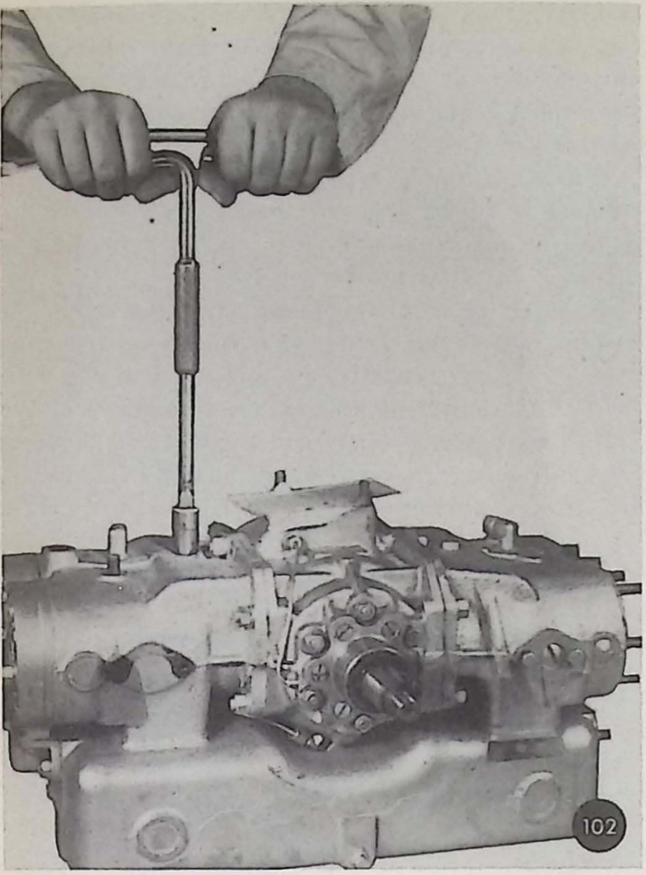
TO REMOVE AND INSTALL MUFFLER

To Remove Muffler: Remove water elbows connecting each end of muffler with each cylinder head. Remove long cap screw in center of each cylinder block. Fig. 102. (These cap screws run through cylinder block into muffler.) Remove two nuts from the two slotted positions in muffler, shown in Fig. 103. Turn motor upside down. Remove four large square head pipe plugs from bottom of muffler and push in carbon deposit. Fig. 104. Insert socket through holes in muffler to remove four cap screws. Fig. 105. (NOTE: Socket should fit firmly onto handle.) Jar muffler loose and lift from motor.

To Install Muffler: Scrape exhaust gasket surfaces on both muffler and cylinder clean. (NOTE: Make sure there is no sand or metal chips or metal pieces inside muffler because they will fall inside motor when motor is turned upside down.) Place gaskets



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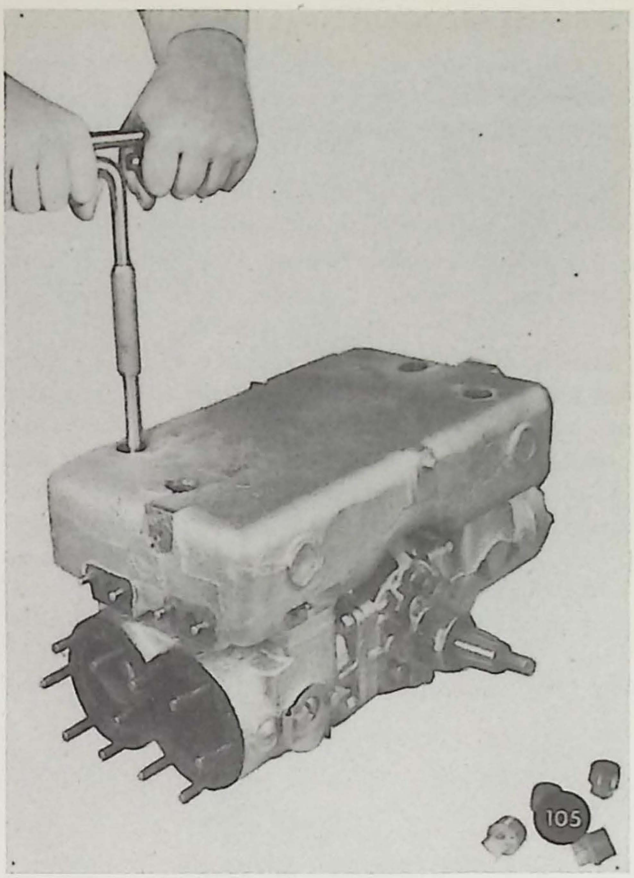

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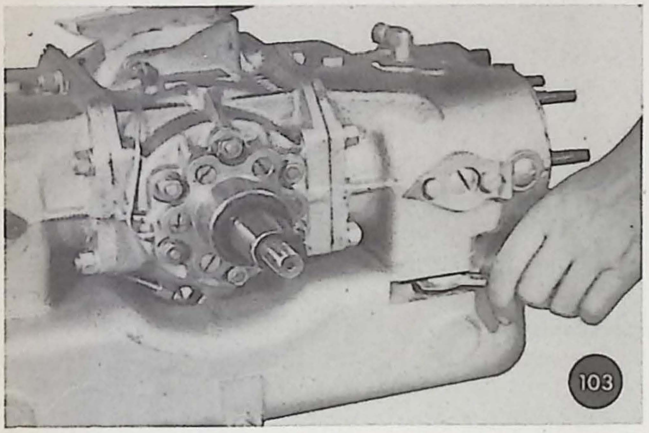

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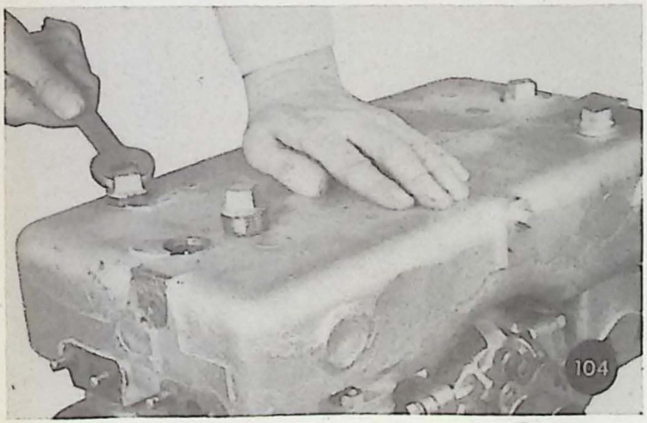

104

on muffler. Place motor on muffler by inserting studs on cylinders through hole in gaskets and holes in muffler. Insert long cap screws keeping gaskets in line but do not tighten. Turn motor on either cylinder head end and insert four cap screws. (NOTE: There are no washers used on these four cap screws because of the danger of loose washers falling through ports into cylinder.) Put nuts on the two studs and tighten the six cap screws and two nuts tight.

Replace pipe plugs. Replace water elbows on each end of muffler.

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TO REMOVE AND INSTALL CYLINDER BLOCKS

Remove nuts and washers holding cylinder heads to cylinder block—if heads appear to stick to cylinder, tap lightly on side of heads with mallet to jar loose.

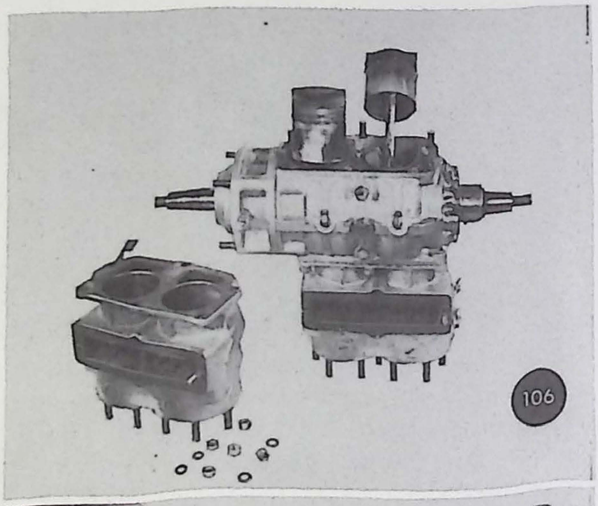
Remove nuts and washers holding cylinder block to crankcase. Pull cylinder block from crankcase —if still held fast, tap side of cylinder lightly with mallet to jar loose. Carefully work cylinder off over pistons. Remove old gasket and discard.

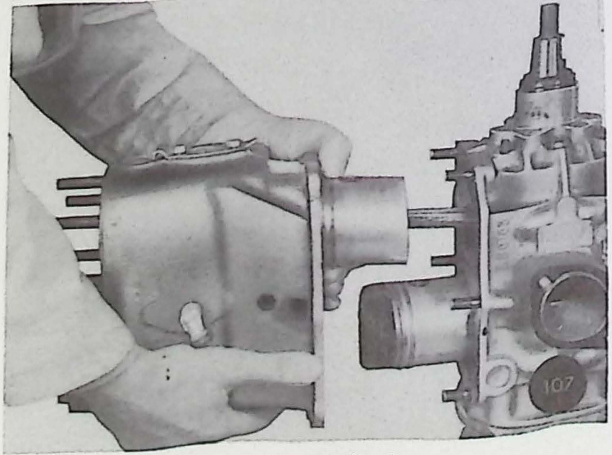
To install cylinder (the cylinder with heat indicator boss is the starboard cylinder)—first make sure cylinder bores and mounting locations on both cylinder and crankcase are clean. Coat cylinder bores with light film of oil. Smear oil over pistons (this assembly should not be made dry—oil all parts). Slip new base gasket over crankcase studs. Work cylinder block on over pistons carefully at same time compressing piston rings with fingers or sheet metal compressor and pliers, as in Fig. 107. Exercise caution in this assembly—do not force cylinder on. It should slip on easily without binding to prevent springing of the connecting rods or pistons and to guard against breaking of piston rings. (Groove pin in piston must be in gap between ends of rings.)

When cylinder is finally mounted, replace lock washers and base nuts—draw up snugly but do not tighten at this time since it is necessary to line up cylinders with the muffler.

To align cylinders, set engine assembly on the muffler—insert and tighten two long bolts (running through cylinder blocks) as illustrated in Fig. 102.

Cylinder nuts not having been tightened, cylinders are aligned with muffler mounting location when drawing up on long bolts. (Cylinders are free to shift position slightly, thus permitting them to lie flat on muffler to prevent distortion when completing assembly.) Remove engine assembly from muffler—tighten all cylinder base nuts evenly and securely to insure tight cylinder mounting.

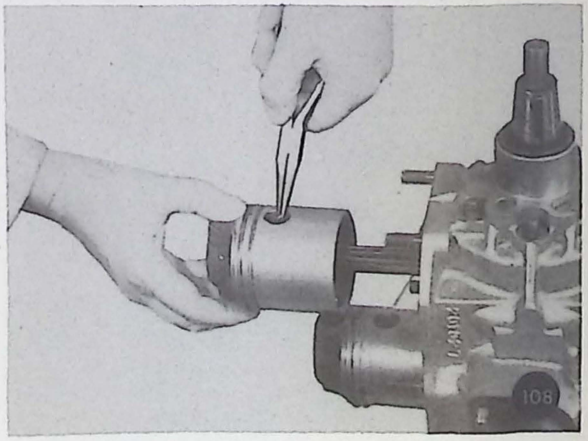




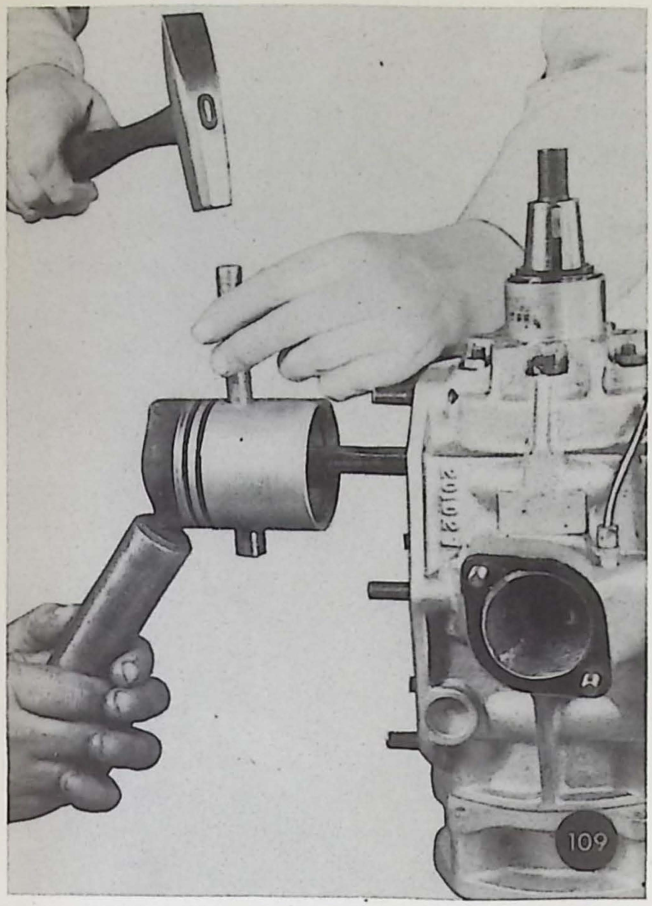
Installing Cylinder

TO REMOVE PISTON FROM CONNECTING ROD

Wrist pin is held in position in piston by two small spring clips which fit in grooves cut into wrist pin hole in piston. To remove these clips, simply grasp protruding end with a pair of pliers and pull out with turning motion as illustrated in Fig. 108. (Turn in direction that will have tendency to compress clip.)



Removing Spring Clips



Driving out Wrist Pin

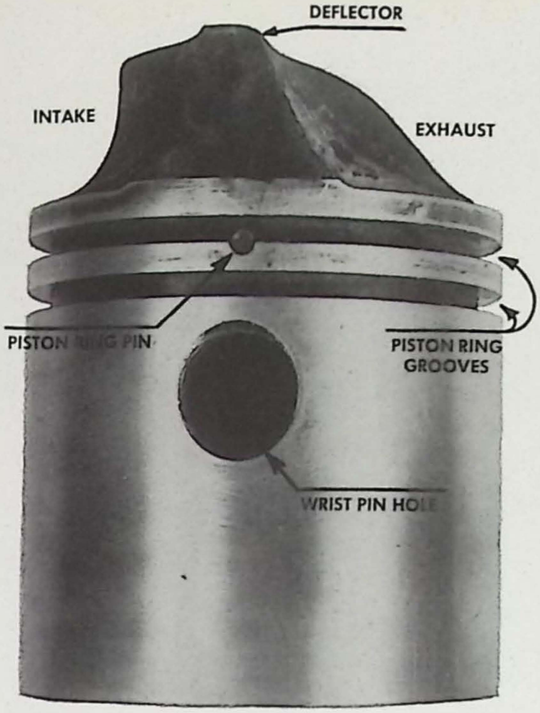
Have someone support head of piston with heavy iron, then drive wrist pin out, using flat punch (slightly smaller than diameter of wrist pin, and preferably with a piloted end that fits into hole in wrist pin) and hammer as shown in Fig. 109. Guard against scuffing wrist pin hole. If pin drives too hard, warm up a bit to expand. (Use blow torch, but hold at distance from piston to guard against overheating—don't let flame play directly against piston—(Be careful of fire).

TO INSTALL PISTON

Coat wrist pin and wrist pin bushing in connecting rod with oil.

Heat piston to expand wrist pin holes by immersing in hot water a minute or two. Smear wrist pin holes with oil.

Note shape of piston head. Fig. 110. Straight side on deflector must match with intake port in cylinder when installing. Fig. 103. THIS IS EXTREMELY IMPORTANT. Deflector should face carburetor side of engine or opposite exhaust port (outlet) in cylinder.



Piston 110

Arrange piston in proper position with respect to deflector—insert wrist pin in top hole of piston. Place over connecting rod. Have someone support piston. Fig. 109. Then carefully drive wrist pin home.

Install lock rings—but BE SURE THEY COME TO REST SECURELY IN GROOVES IN WRIST PIN HOLES PROVIDED FOR THIS PURPOSE.

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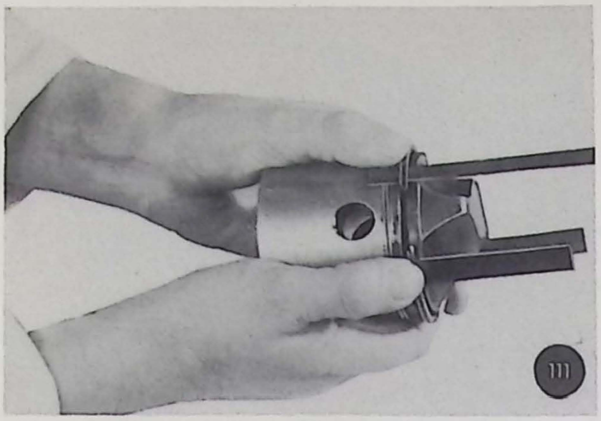
TO REMOVE AND INSTALL PISTON RINGS (In Cases Where New Pistons Are Not Available)

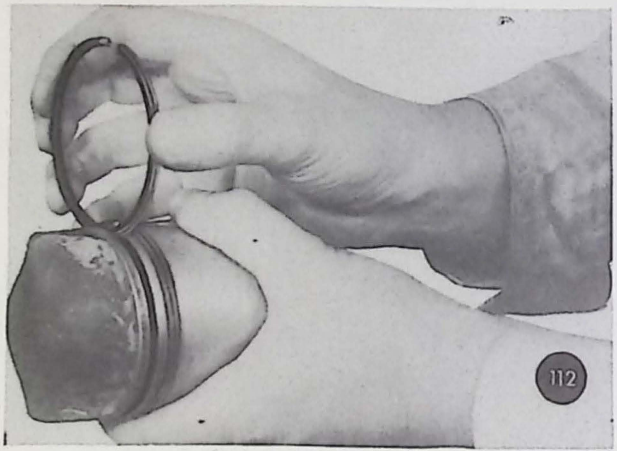
Cut three strips of thin sheet stock (tin plate or brass shim stock approximately .005" thick) about $\frac{5}{16}$" to $\frac{3}{8}$" wide and five to six inches long. Work first strip under piston ring at gap, second strip under ring at other side of ring gap. Third strip can be inserted next to either of the other two. Work this strip half way around piston as in Fig. 111. Ring should then be sufficiently and evenly



Removing Piston Rings

expanded to permit sliding off piston over strips. Install rings in reverse order—place strips equidistant around piston, slide ring down over strips to its respective ring groove. Pull strips out. Repeat same operation for second ring.

Prior to installing rings, be sure each ring fits in groove with no indication of tight spots or binding. This can be determined by rolling each ring in their respective grooves, around piston as illustrated (Fig. 112).



Checking Fit in Piston Ring Groove

Resistance to rolling ring in grooves will be encountered where tight spots exist—this may be result of particles of carbon, burrs in piston ring grooves or high spots on edge of ring. Check grooves to see that all trace of carbon has been removed. Fig. 112.

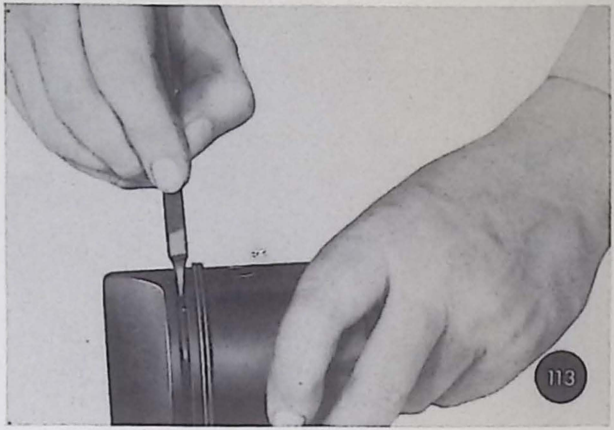
If burrs exist, they usually can be carefully removed with a sharp edge scraper.

High spots on edges of rings are not frequent occurrences, but if such exist, they can be dressed down by rubbing edge of ring lightly over a piece of very fine sand paper or emery cloth placed on a flat surface.

NOTE: Rings must fit freely in (piston ring) grooves. Rings and piston grooves are machined to correct size at factory and will fit properly, provided, of course, all carbon has been removed from grooves and no burrs are present.

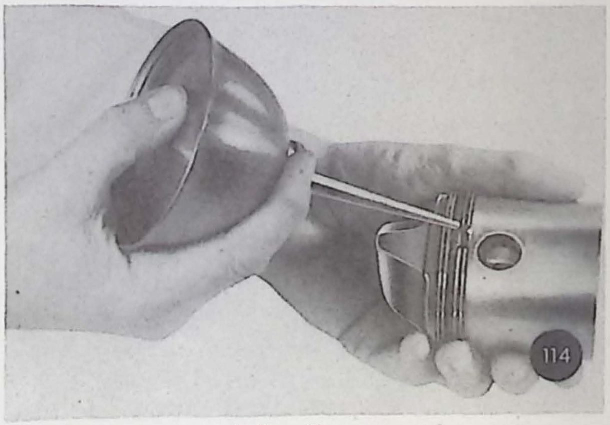
CLEAN PISTON RING GROOVES

Piston ring grooves frequently become clogged with carbon after long periods of operation, which causes rings to stick, thus becoming partially inactive to result in loss of compression and faulty operation of the unit.

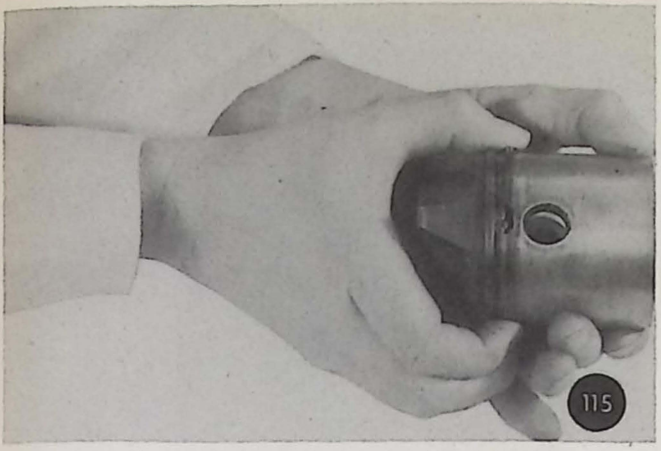


Scraping Carbon from Ring Grooves

A suitable carbon scraper can be easily made from a discarded file or hack-saw blade. Make it slightly narrower than grooves in piston and sharp enough to scrape out accumulated carbon. (Fig. 113.) Be careful not to scratch piston or walls of ring grooves when performing this operation. Handle pistons carefully—burrs and nicks are result of rough handling or dropping.



Oil Ring Grooves



Spreading Oil in Ring Grooves

After installing rings, it is important to place a few drops of oil in each ring groove. (Fig. 114.) Spread oil by turning each ring around piston, one or two times, but be sure each ring comes to rest with groove pin in gap between ends of ring. Fig. 115.

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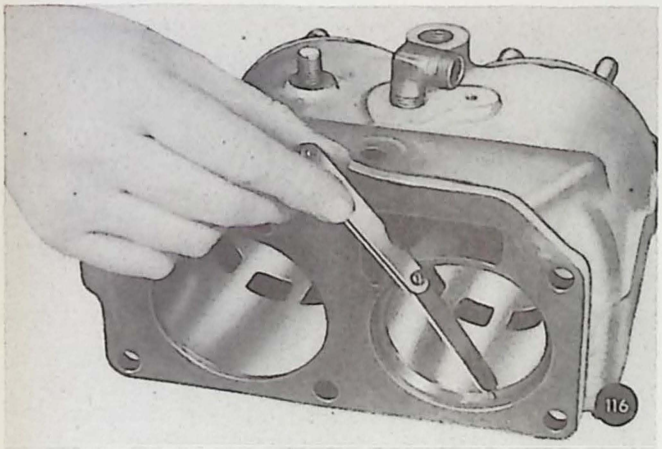
CHECKING PISTON RING GAP

Piston rings are ground to size at factory but it is advisable to check gap clearance to ascertain that recommended .008 to .020 is maintained. Place each ring squarely in its respective cylinder. Insert feeler gauge between ends of ring (gap) as in Fig. 116. Repeat same operation for each ring in respective cylinders (check each two rings in cylinders in which they are to operate). If noted gap clearance falls short of .008", file end of ring carefully (and squarely) until desired gap is obtained. If gap is in excess of .020", check cylinder for size —cylinder size is 2.750-2.751.

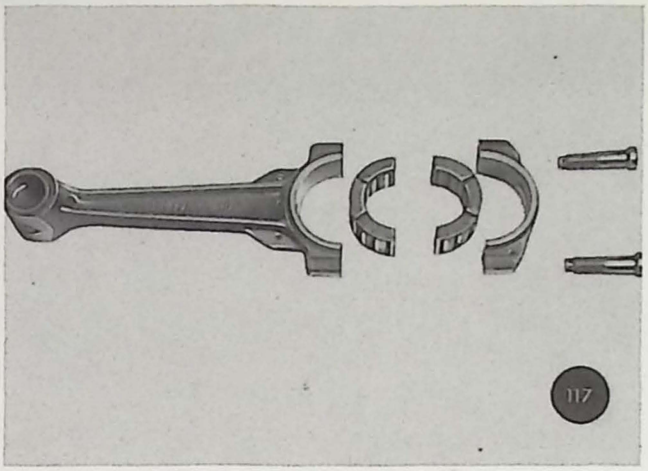


Checking Piston Ring Gap

TO REMOVE AND INSTALL CONNECTING ROD

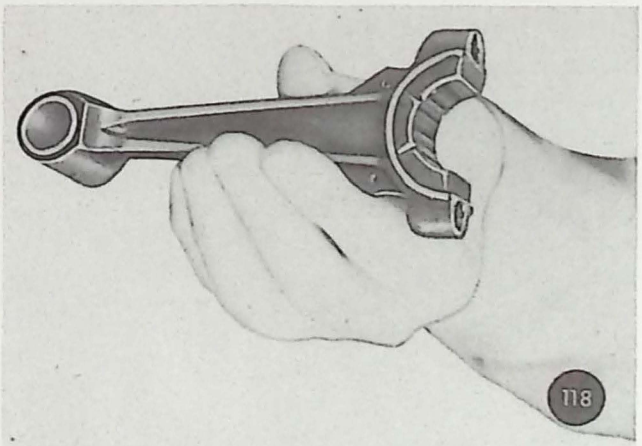
Loosen and remove connecting rod screws (use T handle screw driver since screws are set very tight—be sure bit of screw driver properly fits slot in screw to prevent damage to it).

NOTE: Connecting rod operates on roller bearings—two rollers each set in a cage. There are six cages per each bearing assembly, thus twelve rollers in all. Fig. 117.



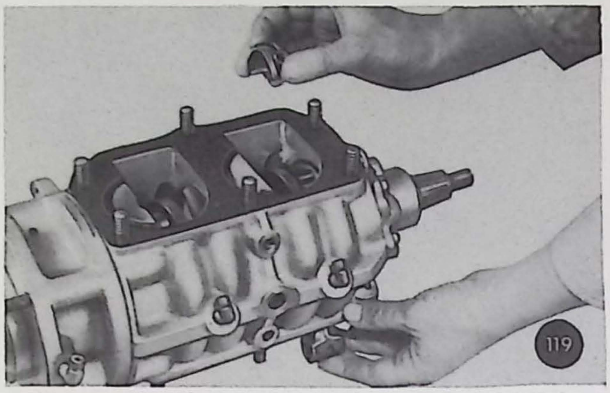
Connecting Rod Assembly

Remove connecting rod cap—at the same time support connecting rod with hand to prevent rollers and cages spilling. Lift three cages with rollers from top half of crank pin. Remove connecting rod with rollers and cages (3) in place from crank pin. It is advisable to place roller bearings, cages and rod cap in small cloth sack and tie same to corresponding connecting rod. Keep connecting rod cap and rollers together and identified with proper crank pin (connecting rod and cap are ground as a unit and are not interchangeable).

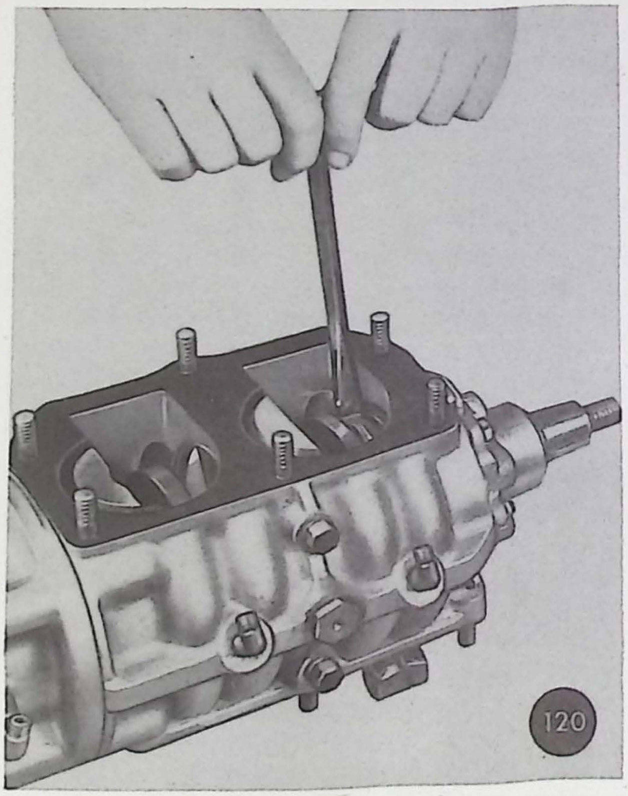


Rollers and Retainers Placed in Connecting Rod

To install connecting rods—Wash connecting rod and bearing assembly in gasoline to insure their being clean and free of grit. Coat connecting rod bearing surface with light grease—smear grease over roller and cage assemblies. Place three cage assemblies in position in connecting rod. Fig. 118. Place connecting rod in position on respective crank pin—place three roller and cage assemblies on exposed half of crank pin. Replace connecting rod cap as in Fig. 119. NOTE: Rod and cap are marked—be sure to match mark on cap with mark on rod. Replace connecting rod screws—tighten securely as illustrated, Fig. 120.

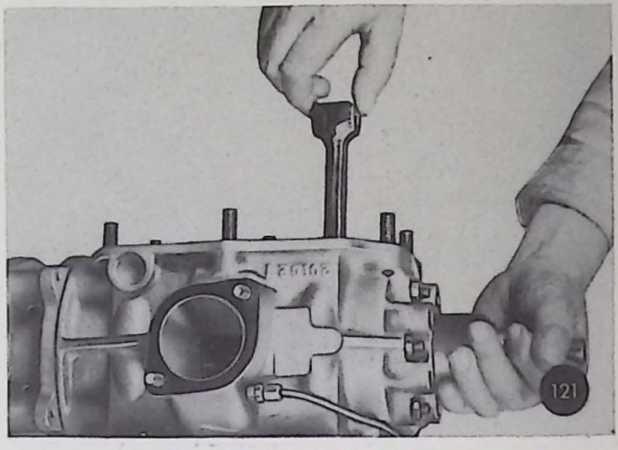


Installing Connecting Rod



Tightening Screws

No locking arrangement is provided for screws—therefore it is important they are drawn up very tight to prevent their becoming loose during operation of the unit.



Checking for Tight Spots and Binding

In tightening connecting rod screws one man should handle the T handle screw driver and another man hold the connecting rod in proper position. It is essential that these screws be made tight. Another method is to clamp one end of crankshaft in a coffered jaw vise and set the other end of crankshaft on a block or small box. This holds the crankshaft rigid but the connecting rod must be held in position by a second man.

After rods are securely tightened to crankshaft the grease used in assembly of rollers should be washed out with gasoline, and some oil put on bearings. (If the grease is left in, it might cause the rollers to slide rather than turn when motor is first started.)

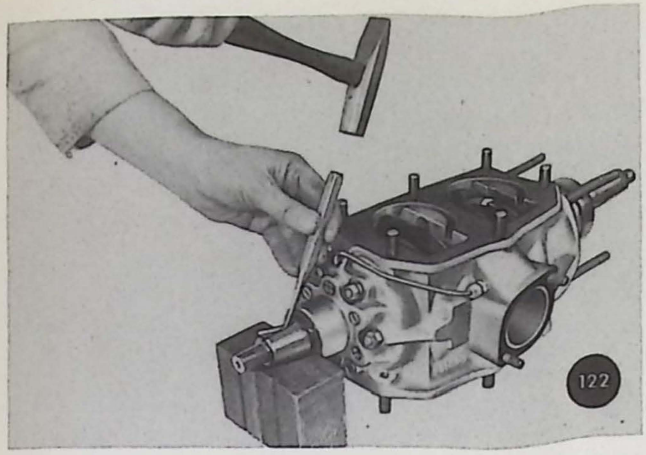
Check each rod for possible tight spot on pin. Swing from side to side and turn crankshaft to check for tight spot. Fig. 121.

* * *

TO REMOVE AND INSTALL CRANKSHAFT KEY

If necessary to remove crankshaft key, rest end of crankshaft on heavy block of iron or on a vise—drive key out with small flat punch as shown (Fig. 122). Be careful not to use a punch that will wedge in keyway.

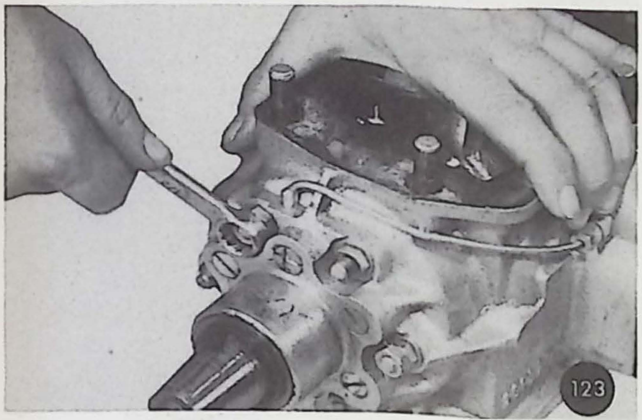
To install key—place key in position and carefully drive home with small hammer. Always provide a heavy block of iron or a vise as a support for end of crankshaft to absorb shock.



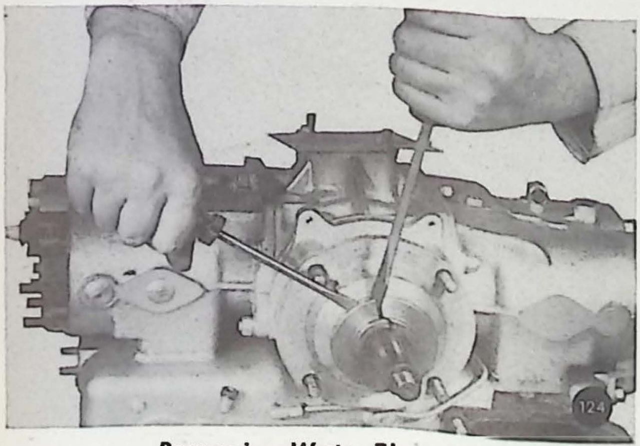
Driving out Key

TO REMOVE CRANKSHAFT

Remove nuts (crankshaft thrust support) Fig. 123, but DO NOT DISTURB THE SIX (6) SCREW DRIVER HEADLESS SET SCREWS UNDER ANY CIRCUMSTANCES AT THIS TIME.

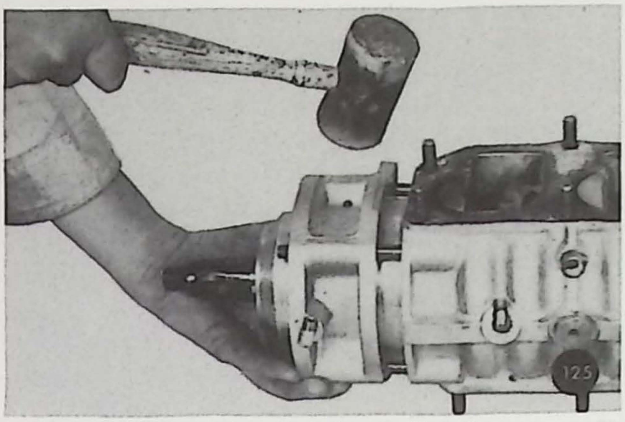


Removing Thrust Support Nuts



Removing Water Thrower

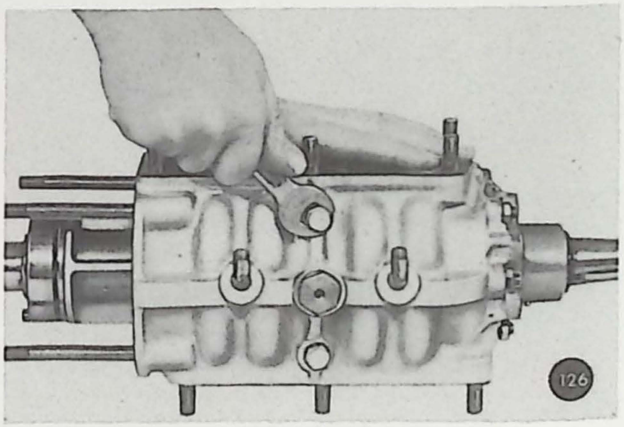
Remove water thrower as shown, Fig. 124. Insert screw driver bit in slot to expand slightly—pry off with second screw driver.



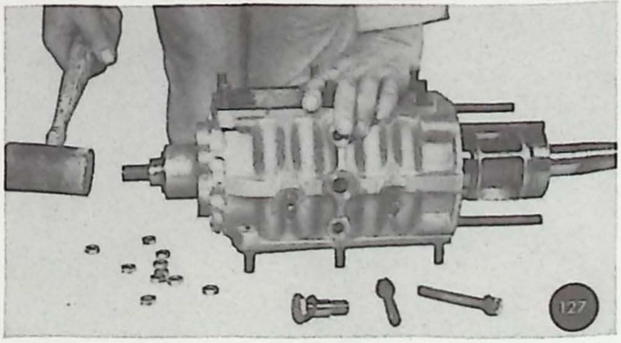
Removing Crankcase Head

Remove crankcase head—tap lightly against head with mallet, at same time pulling with other hand as illustrated, Fig. 125.

Remove three screws on side of crankcase. Fig. 126.

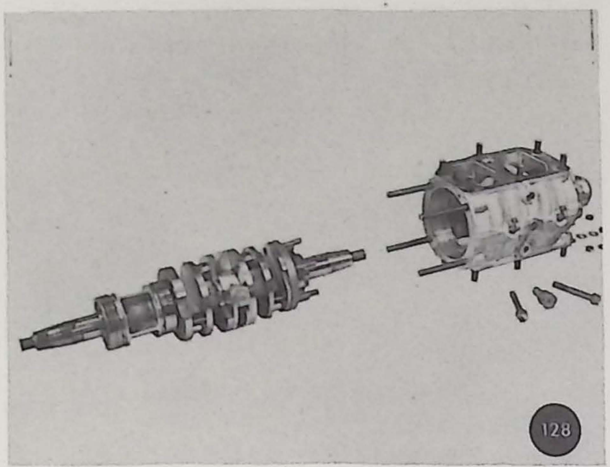


Removing Center Head Screws

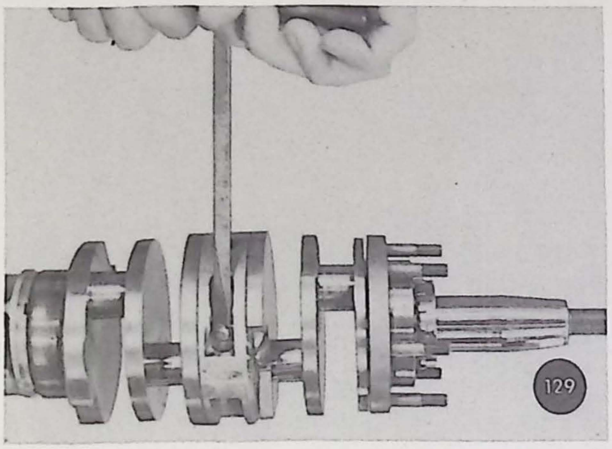


Driving out Crankshaft

Gently drive crankshaft out with mallet as in Figs. 127 and 128. If center head sticks tight in crankcase, warm up outside of crankcase around center head to expand the aluminum and, therefore, causing the center head to become loose. CAUTION: Do not play flame inside crankcase.



Remove center head—use T handle screw driver to obtain necessary force since screws are driven very tight at factory, Fig. 129. Care should be taken to see that bit on screw driver fills screw slot, otherwise it is possible to damage slot to point where screw cannot be removed. (Be careful not to spill rollers when removing head from center journal.)



Removing Center Head Screws

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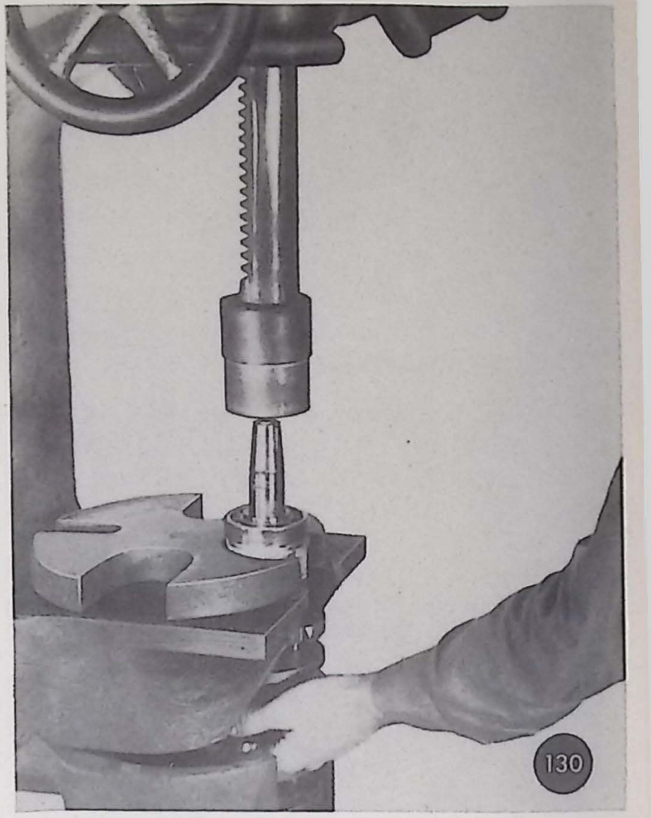
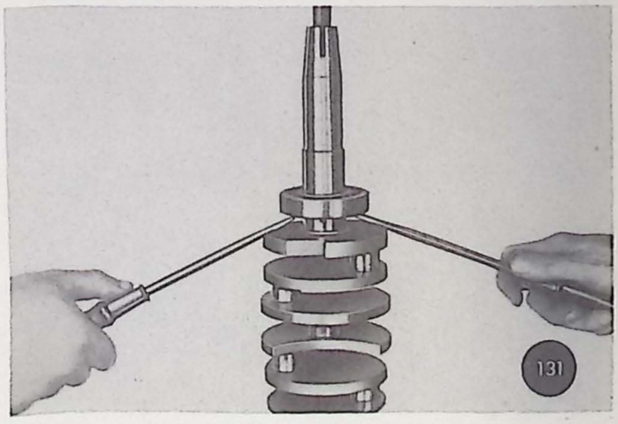
TO REMOVE AND INSTALL BALL BEARINGS ON CRANKSHAFT

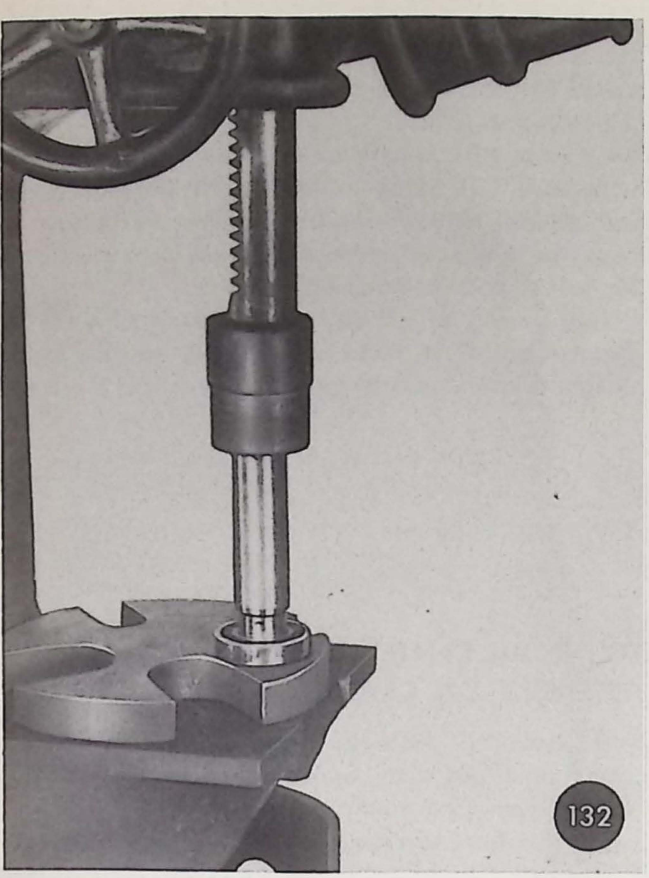
Press end bearing (impeller end of crankshaft) off as shown in Fig. 130. Be careful not to damage threads on end of crankshaft. Remove assembly from arbor press—lift spacer off crankshaft. Wedge two heavy screw drivers between bearing and cheek of crankshaft—pry bearing off as shown in Fig. 131. (If two screw drivers are insufficient, use three or four evenly spaced around bearing.)



Pressing End Bearing

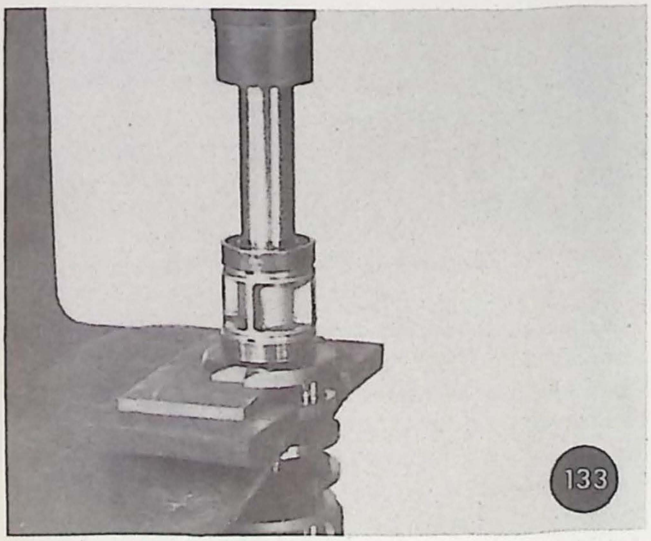


Removing Inner Bearing



Driving Bushing into End Bearing

Push bushing out of end bearing—do not scratch or otherwise mar outside edge or shoulder. This surface is part of seal in the pump and must be perfectly smooth to prevent leakage. Install bushing in new bearing—press in as shown, Fig. 132. Use a brass bar in this operation so there will be no danger of injury to the seal surface.



Pressing Bearings into Position

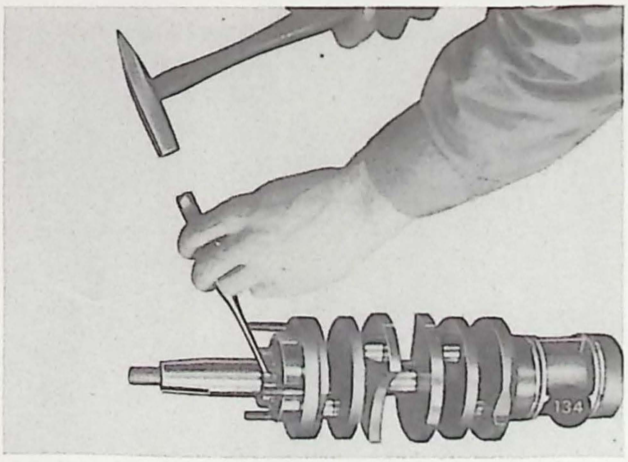
Arrange crankshaft on arbor press as shown in Fig. 133. (Support crankshaft with flat piece of iron so that all pressure is applied to cheek of crankshaft.) Press first bearing into position up against shoulder on crankshaft. Replace spacer, previously removed. Slide end bearing and bushing assembly down over crankshaft. Shoulder of bushing (seal face) must be directed upward. Press into place against shoulder on crankshaft. Be sure to use brass sleeve to avoid damaging seal face. The end of brass sleeve which touches seal face must be square and smooth.

TO REMOVE BEARING ON MAGNETO END OF CRANKSHAFT

Bend all lugs of lock plate away from nut on crankshaft. Support crankshaft firmly. NOTE: This nut is provided with a LEFT HAND THREAD, thus to remove, it must be turned to right. Use a punch and hammer as shown in Fig. 134. (Place tip of punch in slot on nut.) Several sharp blows on punch should loosen nut, then unscrew by hand.

To remove bearing and thrust ring—wedge two or four heavy screw drivers (opposite sides) under thrust ring. Carefully pry bearing and ring loose. Fig. 131.

Clean surfaces thoroughly before installing new bearing—spread a few drops of oil on crankshaft journal. Place thrust ring in position on crankshaft, followed by bearing. Press bearing on until it comes to rest against shoulder on crankshaft. Support crankshaft on press as shown in Fig. 133 to prevent springing of shaft during operation.



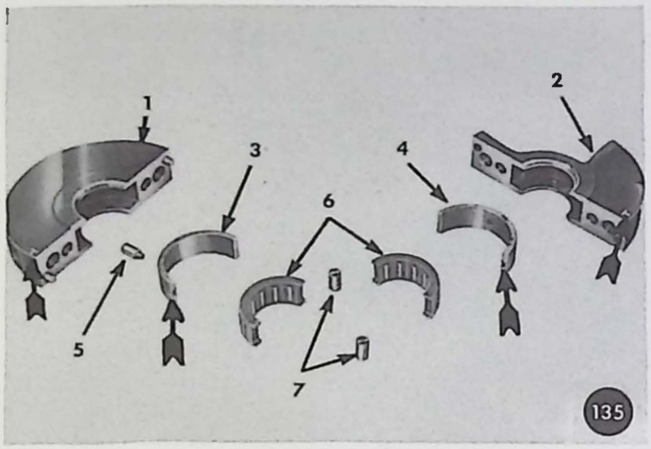
Removing Nut with Punch

Install new lock plate. If you use old lock plate be sure the tongue and the lugs are in good shape and not ready to break off.

Attach and tighten nut in manner similar to which it was previously removed, bearing in mind that a LEFT hand thread is used here (turn left to tighten). Be sure nut is made secure. Bend one lug to fit in slot on nut and all the other lugs up against nut to prevent its loosening later on when engine is running.

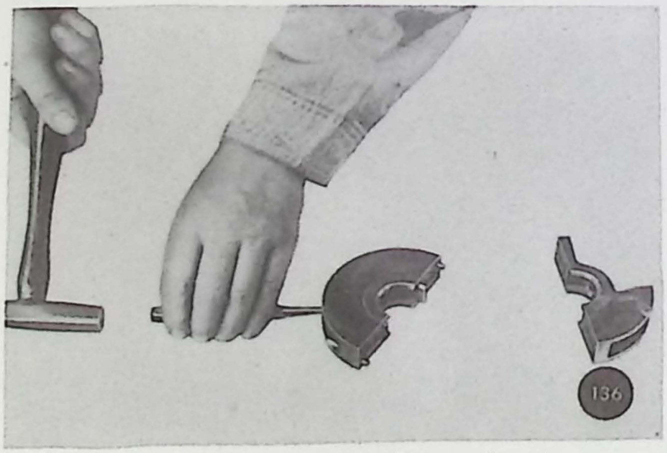
TO REMOVE AND INSTALL BEARING RACE IN CENTER HEAD

Bearing race is made up of two pieces—3 and 4, Fig. 135, which fits into crankcase head, sections 1 and 2 respectively. To prevent race from turning in head assembly when engine is running, piece 3 is held fast in head section (1) by pin (5) which is driven into the head (1)—piece (4) simply sets in head section (2).



135

Center Head Bearing Assembly



136

Removing Race from Center Head

To remove race (3) from head (1) drive pin (5) out of head as shown in Fig. 136. Race (4) is removed by pushing on end of piece to revolve it out of head section (2).

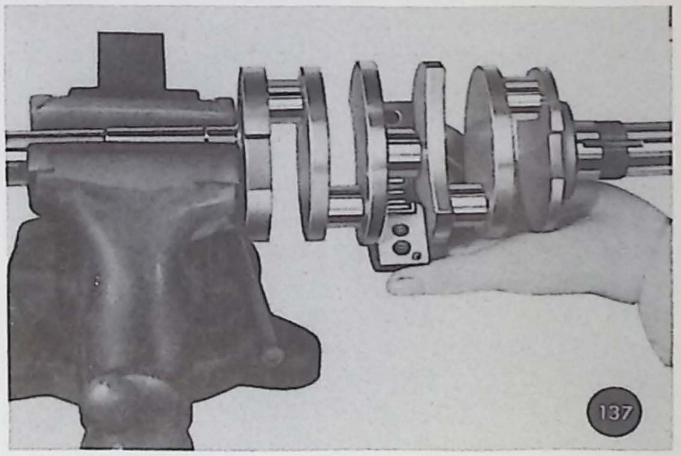
To install Bearing Races—replace pin (5). Replace race (3). Ends of race must be flush with head section (1). In event one end of race protrudes beyond face of head section, turn race end forward to correct position.

Note letter "X" on end of each race (3 and 4), install race (4) in head section (2) so that letter "X" on each piece line up on same side.

TO INSTALL CENTER HEAD ASSEMBLY ON CRANKSHAFT

Note letter "T" stamped on each half section of center head and that bearing consists of fourteen (14) rollers and a four piece retainer.

Install rollers in retainer sections as shown (6) in Fig. 137, six rollers in each section. Remaining two rollers (7) fit between retainer sections to complete bearing assembly.



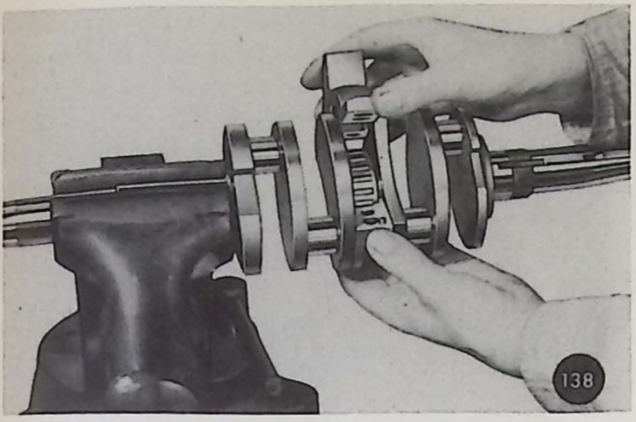
137

Assembling Center Bearing

Place crankshaft in vise, provided with copper or brass jaws to prevent injury to bearing journal. Place one half of roller bearing assembly in crankcase head section (1). Spread a few drops of oil on rollers and race. Place in position on crankshaft center journal as shown in Fig. 137. *IMPORTANT*—Letter "T" on head section must be directed toward magneto end of crankshaft.

NOTES

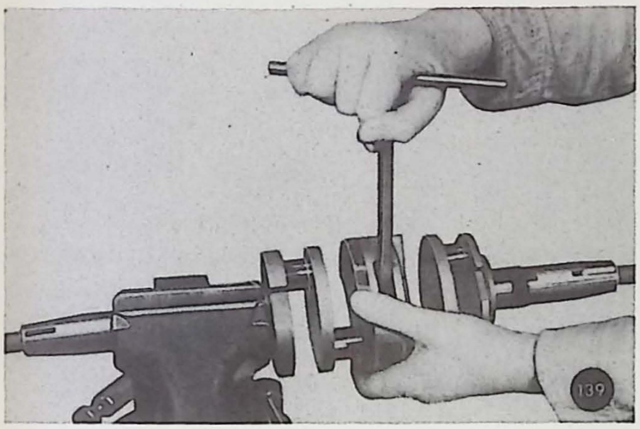
NOTES



Assembling Center Bearing

Place two rollers (7) in position (one at each end of retainer in center head section). Place remaining half of bearing assembly on center journal, Fig. 138. Spread oil over rollers. Place remaining half of center head in position as shown, Fig. 138. Letter "T" must be directed toward magneto end of crankshaft and match with letter "T" on other section of head assembly.

Replace screws and draw up tightly with T handle screw driver. THESE SCREWS MUST BE MADE TIGHT.

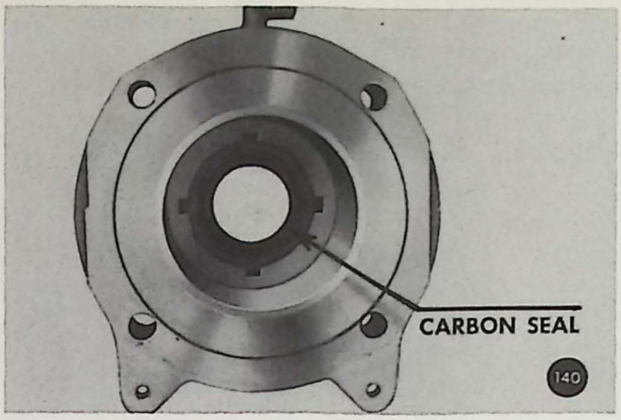


Tightening Center Head Screws

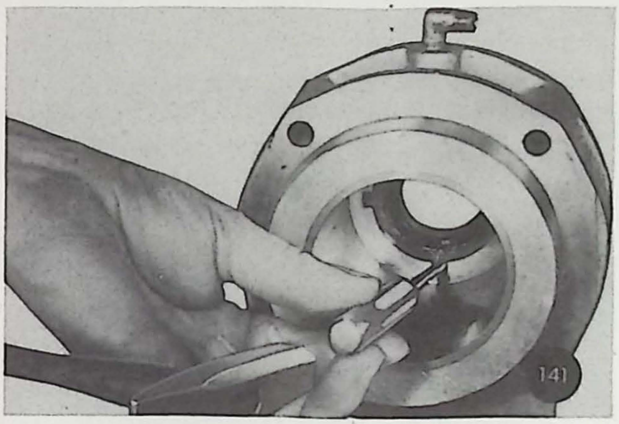
☆

TO REMOVE AND INSTALL CARBON SEAL IN CRANKCASE HEAD

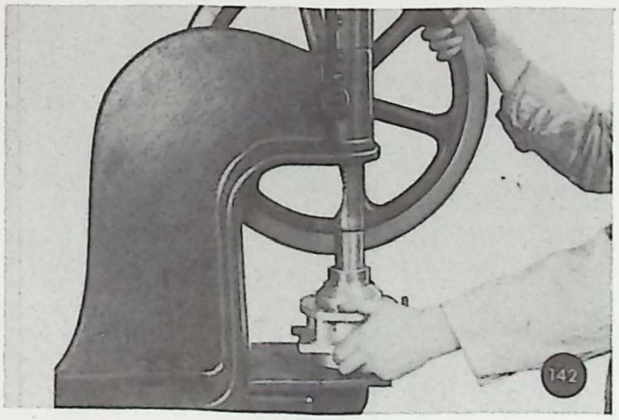
Remove old seal, Fig. 140. Drive from inside of crankcase head using a small flat punch as shown in Fig. 141. Drive against outer edge of seal through slot provided for this purpose. It is extremely *important* side wall of seal seat in head (diameter) is not scuffed or grooved with the punch while seal is being removed. If the groove is deep and extends all the way across seal length it causes compression and oil to escape from the crankcase. In this event it may be possible to block the groove by use of chisel or small punch—close groove by up setting edges. If impossible to satisfactorily accomplish this operation, replace the head, install new seal by simply pressing into position, Fig. 142, being careful not to crack or chip carbon element of seal.



Showing Location of Carbon Seal in Crankcase Head



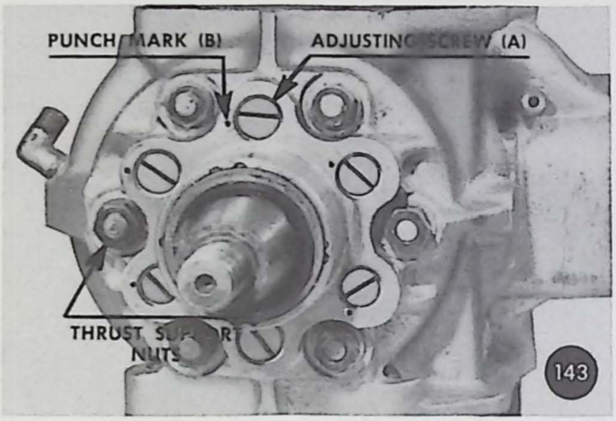
Driving Seal out of Crankcase Head



Pressing Seal into Crankcase Head

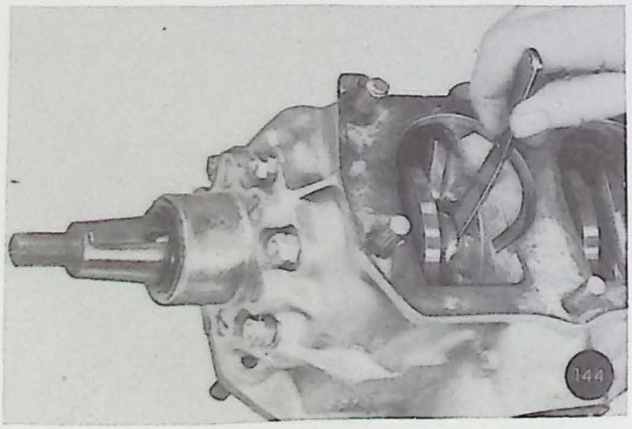
To assemble crankshaft—wash crankshaft and bearing assembly thoroughly in gasoline. Blow excess gasoline off with air hose if available. Place several drops of oil on each ball bearing—turn bearings several times to spread. Oil center head bearing also.

Insert crankshaft in crankcase—apply heat to crankcase if center head fits too tight and proceed in reverse order described above for removing. Replace small washers and nuts on thrust support studs on magneto end of crankcase (Fig. 143). Install only one nut on each stud for the present. Place crankcase head in position (without using nuts) to steady crankshaft. Insert feeler gauge between crankshaft and center head as illustrated, Fig. 144. Repeat same on other side of center head. If thrust support is properly adjusted, clearance between center head and crankshaft should be equal on each side. (Feeler gauge should be no less than .004″ thick.)

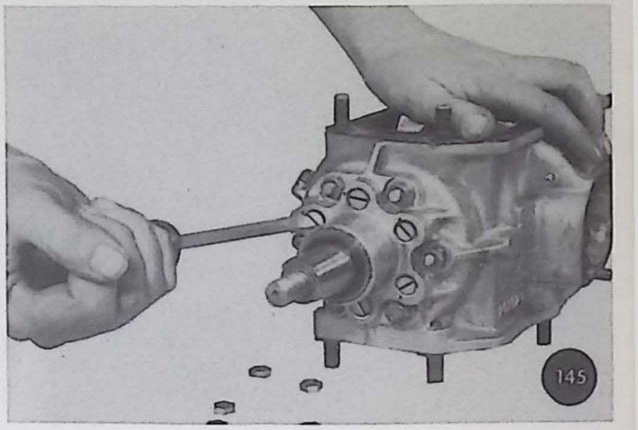


End View of Crankcase

If necessary to adjust thrust support—first, loosen thrust support nuts, Fig. 143. NOTE: Screws "A," center punch marks (B) on crankcase and position of screw slot with respect to punch marks. If clearance between crankshaft and center head is more in front section of crankcase (section next to magneto) turn each adjusting screw (A) slightly to right. That is, each screw should be turned precisely the same amount. This can be governed by distance from punch mark on crankcase to slot in screw as per sketch.



Checking Clearance Between Center Head and Crankshaft



Adjusting Thrust Screws

When last screw has been turned, slot of all screws should be same distance from its corresponding punch mark. NEVER TURN ANY ONE SCREW CARELESSLY. (Under no circumstances remove any of these screws.) Thrust adjustment is extremely critical and must be carefully performed.

After turning all screws desired amount, tighten thrust support stud nuts. Check clearance on both sides of center head again—if equal, install and tighten second nut on studs. If further adjustment is necessary, proceed in like manner, turning adjusting screws in either direction (described above) as required until clearances on both sides of center head are equidistant. Be sure thrust support nuts are tight and secure.

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TO REMOVE CARBURETOR

Remove both panels.

Detach throttle control from magneto plate. Loosen clamp screw and detach drain hose from manifold drain.

Detach gas line between carburetor and filter.

Remove cap screws holding carburetor fast to manifold.

Lift carburetor from manifold.

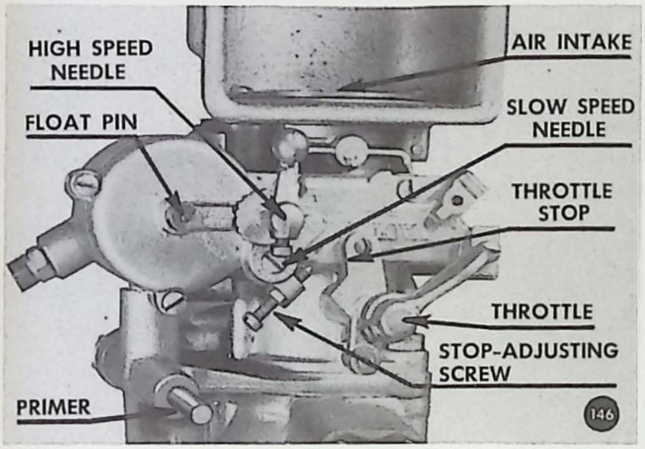
Carburetor should be installed in order reversed from that described above, but install new gasket between carburetor and manifold.

Loosen sediment housing screw, Fig. 152, to facilitate attaching gas line—tighten screw.

TO ADJUST CARBURETOR (Fig. 146)

SLOW SPEED NEEDLE—Screw down gently (use screw driver) to closed position as shown, Fig. 147. Do not screw down too tightly since doing so will distort and damage seat in body—THIS IS IMPORTANT. Unscrew (open) about 1 turn from closed position.

HIGH SPEED NEEDLE—Screw down carefully to closed position, Fig. 148. Do not screw down tight enough to damage seat in carburetor body. Unscrew (open) thirteen notches.


HIGH SPEED NEEDLE
FLOAT PIN
PRIMER
AIR INTAKE
SLOW SPEED NEEDLE
THROTTLE STOP
THROTTLE
STOP-ADJUSTING SCREW

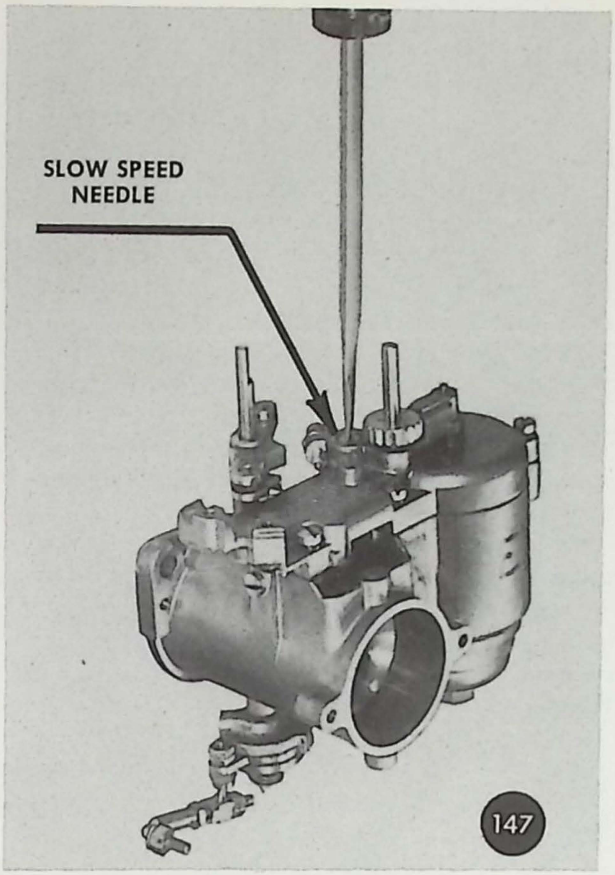
146

Carburetor (Top View)

Start pump—allow to run until normal operating temperature. Slow down—turn slow speed right or left as required to obtain best running condition.

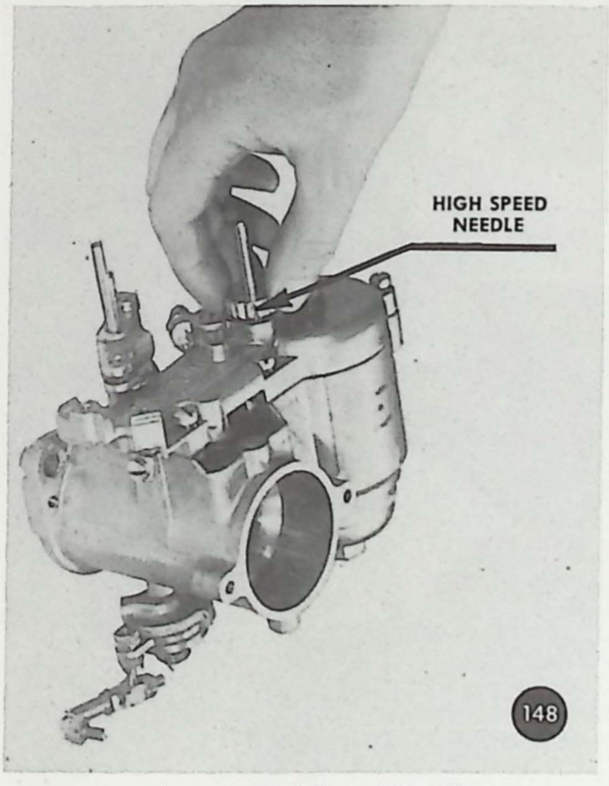
High speed needle is finally adjusted to best running position by moving lever to left or right (lean or rich) as required.

Slow speed is determined by the minimum opening on the throttle valve.


SLOW SPEED NEEDLE

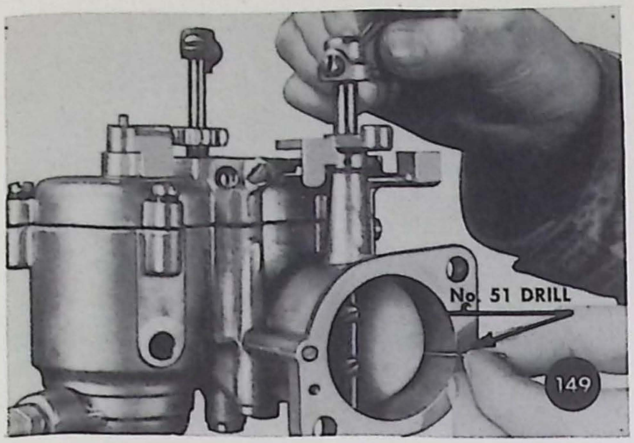
147

Adjusting Slow Speed Needle


HIGH SPEED NEEDLE

148

Adjusting High Speed Needle



Checking Minimum Opening of Throttle Valve

To adjust—set throttle stop on top of carburetor against end of adjustable stop screw and insert a wire of approximately .066" diameter, or No. 51 drill between outside edge of throttle valve and the inside diameter of manifold at the widest point. Fig. 149.

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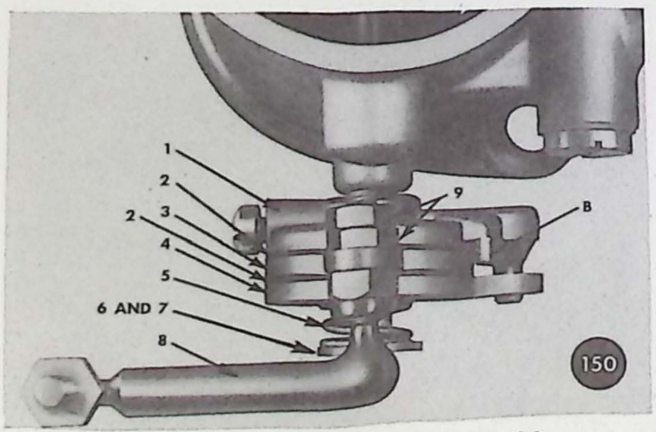
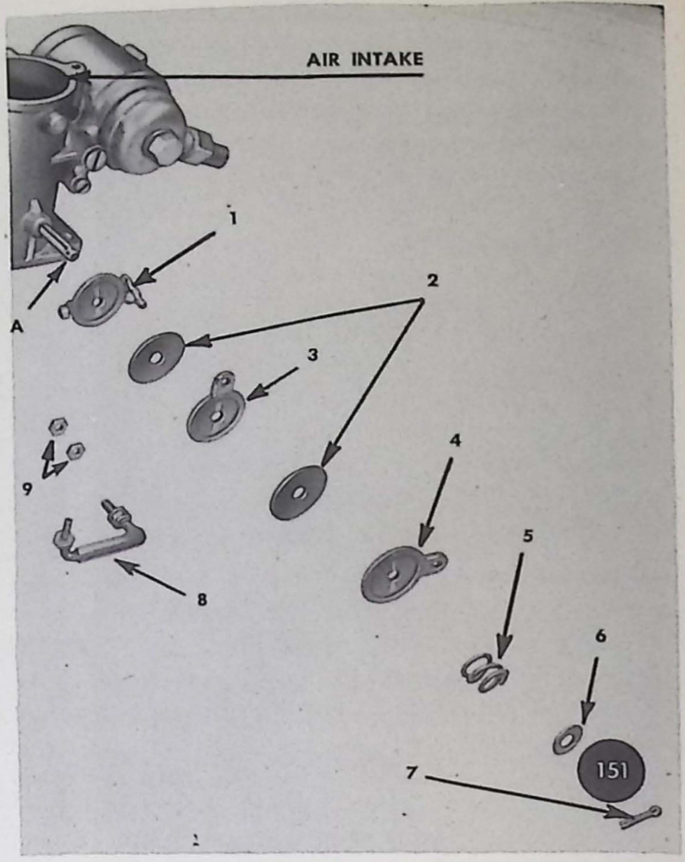
TO ASSEMBLE CARBURETOR THROTTLE CLUTCH

Observe clutch assembly, Fig. 150, and extended view of parts in order of assembly, Fig. 151.



Carburetor Throttle Clutch Assembly



Throttle Clutch—Order of Assembly

To assemble clutch, slip stop casting (1) over end of throttle shaft (a) with screw head to left of assembly or opposite float bowl (do not tighten screw at this time). This should be followed by bakelite disc (2), center bronze plate (3) (boss up), a second bakelite disc (2), lower bronze plate (4) (boss to right as shown, Figs. 150 and 151), clutch spring (5), washer (6) and cotter pin (7).

Control shaft (8) is attached to bronze plate (3) and held fast by nuts (9).

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TO ADJUST CARBURETOR THROTTLE CLUTCH

This adjustment should be made with engine idle (not running), with control shaft attached to magneto plate and with control cylinder properly adjusted as described on page 59. (Upper timing mark on rim of magneto plate lined up with pointer on cylinder.) NOTE: Controls are now set for idling position.

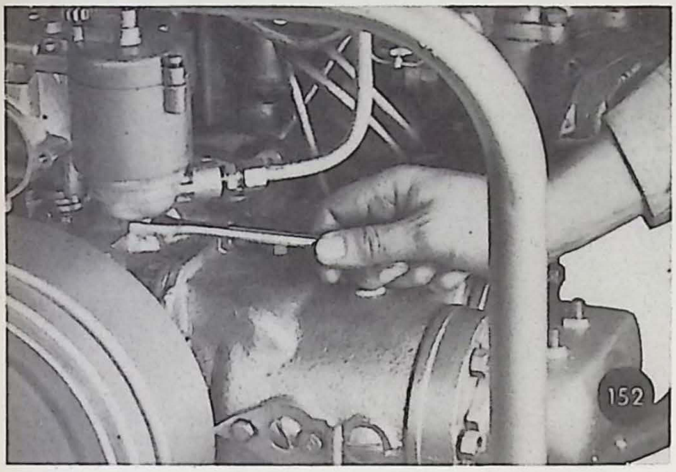
To adjust—move clutch assembly by slipping clutch until clutch stop (b) (Fig. 150) on casting (1), (Figs. 150 and 151) makes contact with boss on center bronze plate (3). (Screw must be loose when adjustment is made.)

Move throttle to SLOW position (when lever on throttle shaft is against end of "Stop" adjusting screw—Fig. 146). Tighten screw in casting (1) securely. If this adjustment is correctly performed

1—Throttle will always be set at slow or starting position when engine is idle (not running).

2—Throttle can be closed when engine is running.

3—Throttle cannot be opened beyond its proper position as determined by the control cylinder.



Removing Carburetor Sediment Basin

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TO INSTALL NEW FLOAT (Carburetor) AND FLOAT VALVE

Unscrew and remove high speed needle.

Remove settling basin.

Remove screws holding carburetor cover to body to expose float and float valve.

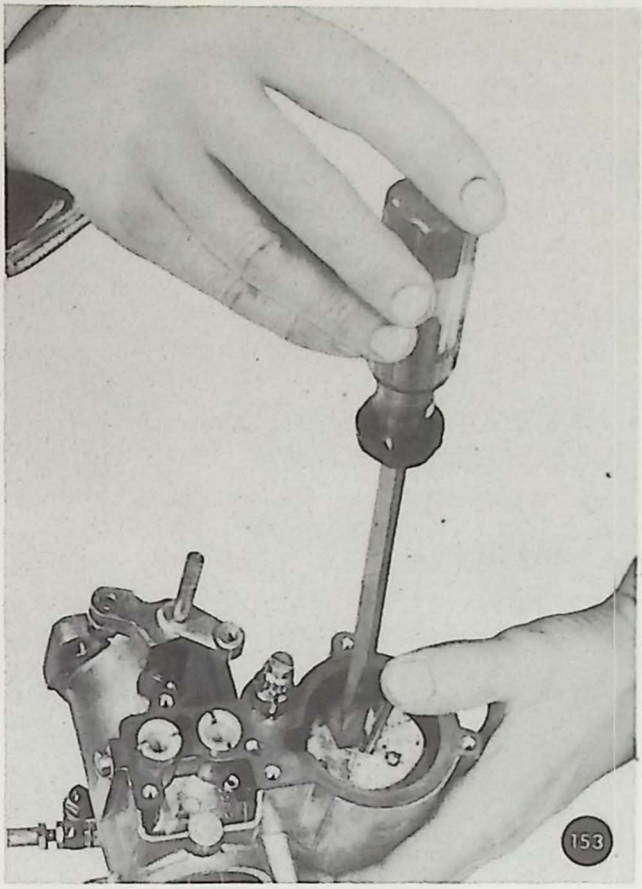
Spread cotter, attaching float to float valve, with screw driver or similar instrument, Fig. 153. Push down on end of float valve with thumb. Pull valve from position in float (out through bottom of carburetor).

Note groove in float valve stem—purpose of groove is to properly locate valve stem in float to maintain correct level of fuel in float chamber.

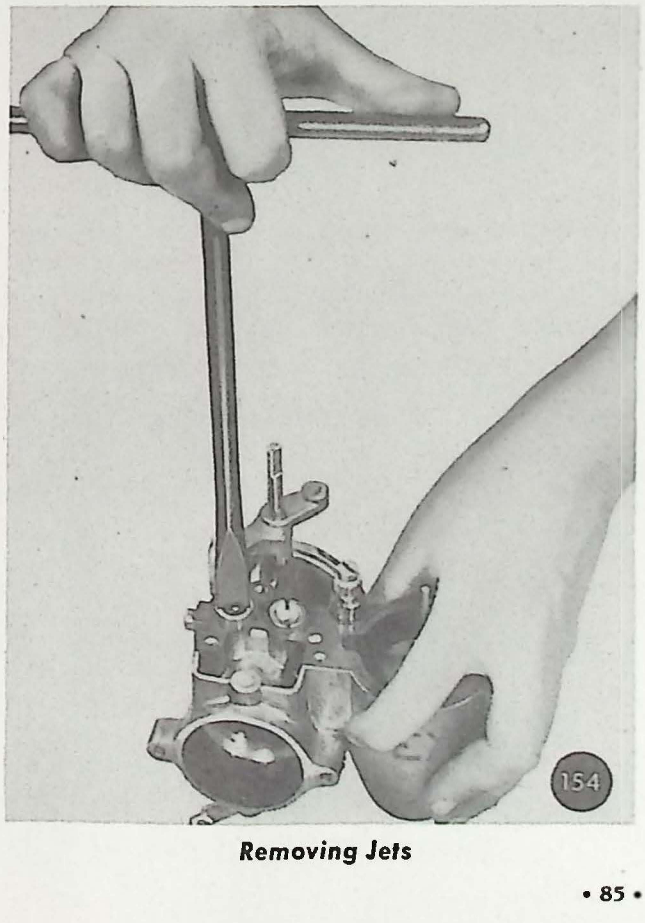
Lift float from float chamber.

To install new float or float valve stem—place float in float chamber, insert float valve until cotter snaps into groove in stem.

Replace carburetor cover. '



Removing Carburetor Float



Removing Jets

Replace high speed needle. Screw gently down to closed position—unscrew thirteen (13) notches to open which is approximately correct setting.

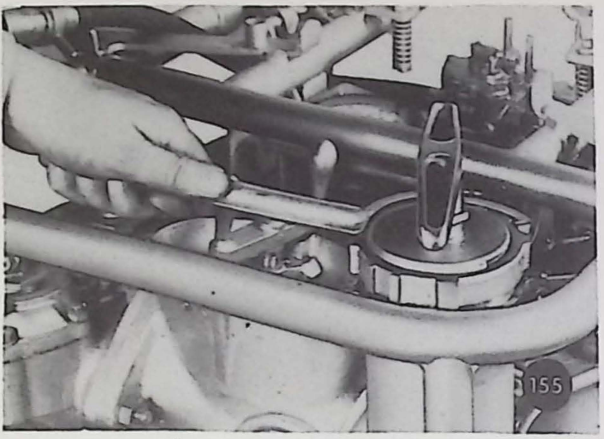
TO REPLACE JETS (Carburetor)

Simply use large screw driver to unscrew when cover is removed. (Be sure bit fits well in slot in jet) Fig. 154.

Slow speed needle valve should be removed for cleaning, etc., when carburetor is removed.

TO INSTALL NEW CUP WASHER (Plunger) HAND PRIMER

Loosen and unscrew cap, Fig. 155.

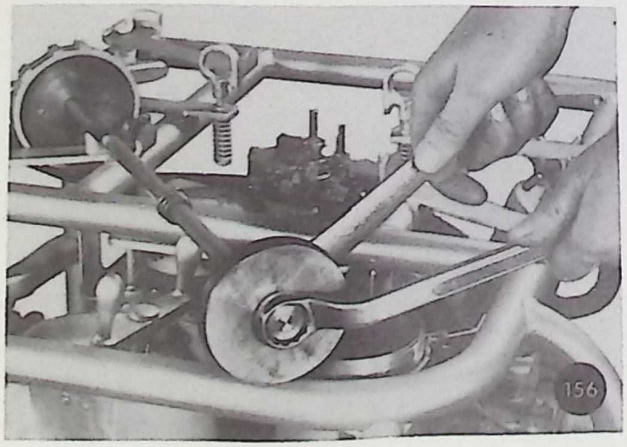

155

Removing Primer Head

Withdraw shaft and plunger assembly from pump cylinder.

Remove nut holding plunger assembly together. This can be accomplished by applying wrench to nut on each side of assembly, Fig. 156.

Remove plunger disc and old cup washer.


156

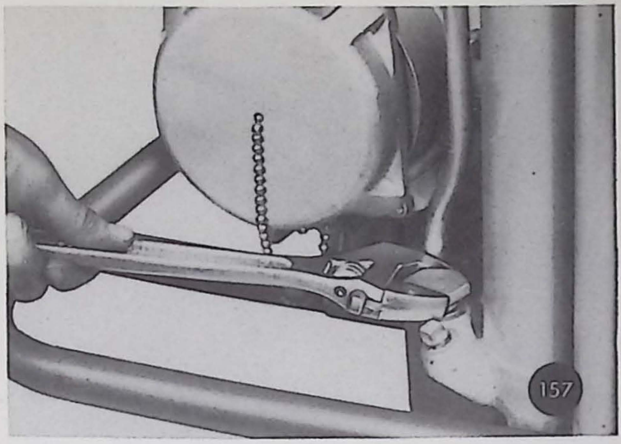
Disassembling Primer Plunger

Install new cup washer with cup side up, or pointing at handle.

Install disc. (NOTE: Be sure spacer washer is between discs to prevent nut pressure from being applied to cup washer.)

Replace nut previously removed, tighten against other nut—use two wrenches. Carefully insert plunger in cylinder (be sure all parts are clean and free of foreign matter to prevent scratching or scuffing cylinder wall).

Replace cap and tighten firmly. In replacing cap be careful not to cross threads. If clamp at upper end of pump cylinder distorts threads, loosen clamp, screw on cap and then retighten clamp.


157

Removing Cap from Check Valve

To replace ball check in primer, remove large nut bottom of pump. Fig. 157. Lift ball check from check valve body. Install check if necessary.

☆

TO REMOVE AND INSTALL PRESSURE REGULATOR

Remove rear panel.

Disconnect all water lines attached to regulator.

Remove nuts holding valve to manifold—simply lift from unit.

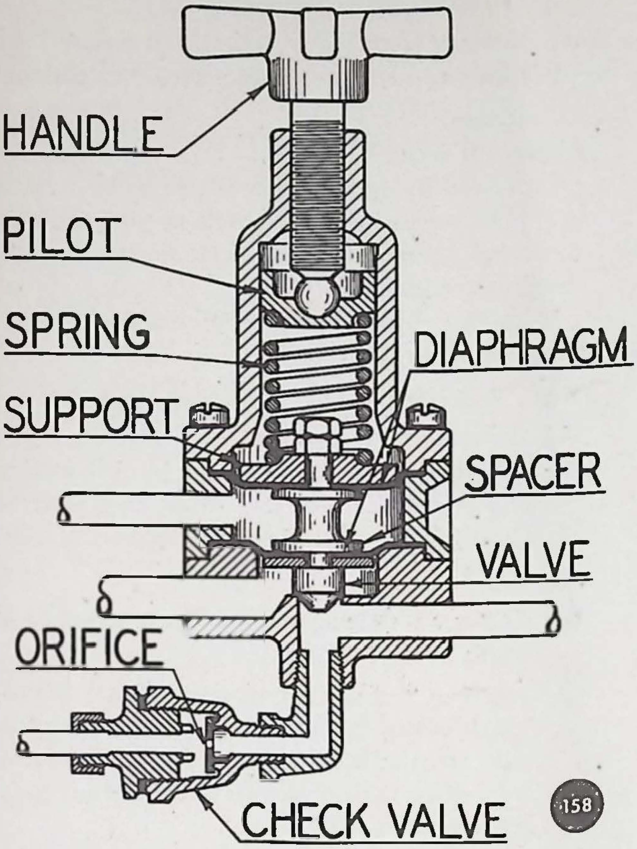
Install valve by replacing in position on manifold—replace and tighten nuts.

Connect water lines, previously detached—make it a point to see that all connections are water tight.

Replace panel.

TO INSTALL DIAPHRAGMS IN PRESSURE REGULATOR

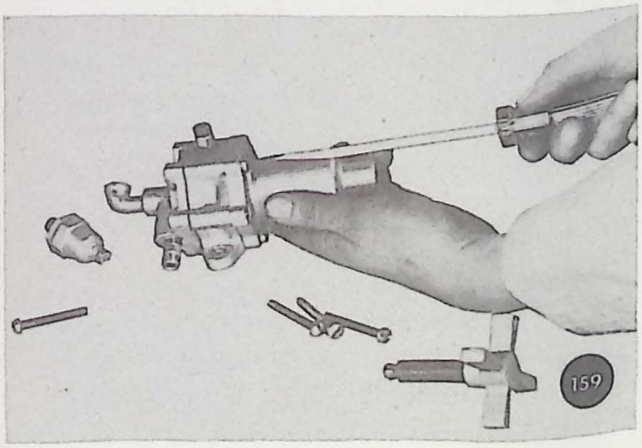
Remove pressure regulator valve, Fig. 21, from pump assembly. Before loosening nuts holding assembly in place on engine, unscrew valve-screw (all way out). Remove assembly from engine (attached to intake manifold).



158

Sectional View of Pressure Regulator

Remove screws holding assembly together, Fig. 159.

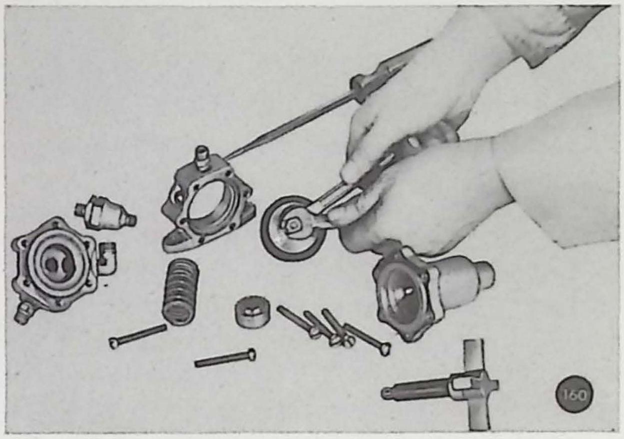


159

Disassembling Pressure Regulator

NOTE: If for any reason the pressure regulator is disassembled, it is advisable to install a new set of diaphragms to maintain original characteristics of the assembly.

Diaphragm assembly is held together by a small shaft and two nuts (one jammed against the other). Place one wrench on each nut. Remove jam nut (top), then second nut; assembly can then be pulled apart.



160

Installing Diaphragms—Pressure Regulator

Install new diaphragm (2), replace nuts and tighten to secure, Fig. 160. Place assembly in body—attach bottom cap. Insert spacer (pilot fits into spring and should face inside of assembly) in top cap. Place this assembly on body—insert and tighten screws.

Be sure mounting locations are clean and smooth.

Take check valve apart to clean—simply unscrew cap to disassemble. Attach to regulator. Replace regulator assembly.

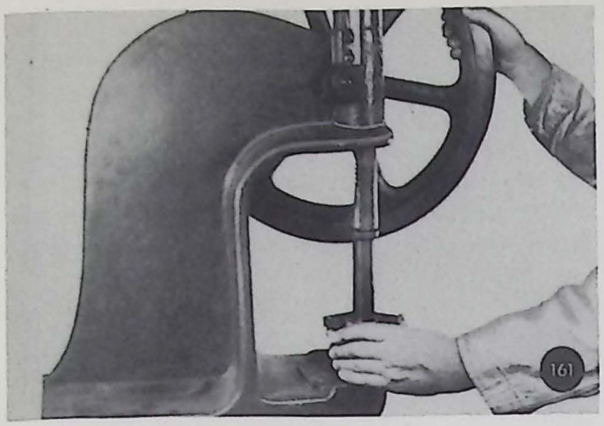
☆

TO REPLACE PLASTIC BUSHINGS IN "Y" VALVE

After removing cap from "Y" valve body, place on press to drive bushing out as shown, Fig. 161. Use a piece of round bar stock (brass, iron or fiber) slightly smaller in diameter than bushing. Bushing drives out from under side of cover.

Install new top (cap) bushing in similar manner, but press in from top side of cover. Press in carefully until bushing comes to rest against shoulder in cap.

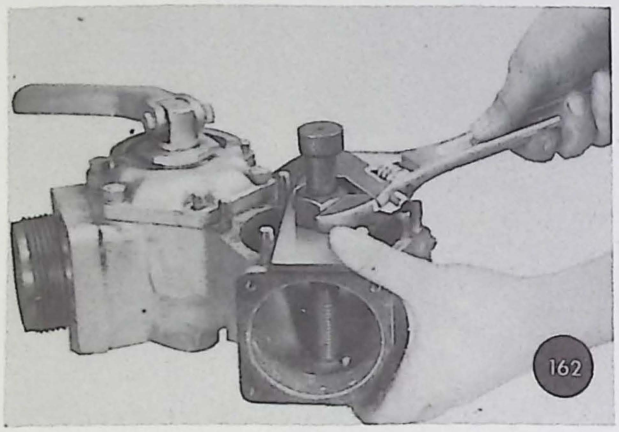
Packing above bushing can be replaced easily by hand.



Pressure Regulator and Check Valve Assembly

The bottom bushing (in body) should be removed by first running a ⅞" standard thread tap into the bushing to cut a thread, obtain a ⅞" bolt about 6" long—cut thread (standard) full length. Screw ⅞" nut on bolt and run up to near head. Drill a 15/16" hole in a piece of flat iron stock about ⅜" thick by 1¾" wide by 6" long.

Run bolt through hole in flat bar—place this assembly in position on "Y" valve body. Turn bolt head by hand to screw into bushing. Draw up on nut as in Fig. 162 to pull bushing from body.



Removing and Installing Plastic Bushing in Valve Cap

Install new bushing by pressing in on arbor press—making certain it is not cocked before applying driving force.

Bushing may require reaming—use .750" reamer —use valve cap to guide reamer.

☆

Inspection

MAGNETO

1. Breaker Points.
   - (a) Clean if corroded or slightly pitted.
   - (b) Adjust if gap is incorrect.
   - (c) Replace if pitted or corroded beyond satisfactory cleaning stage with flexistone.
2. Condenser.
   Replace if weak
   —indicated by excessive arking across breaker points to result in weak spark at plug. Further indicated by necessity of frequent cleaning of the breaker points.
   Complete breakdown of condenser results in no spark at the plug.
3. High Tension Leads (spark plug wires)
   - (a) Replace if damaged or breaking down through insulation (spark jumping from one lead (wire) to the other, or from lead to any part of engine through insulation.

1. Ignition Coil.
   - (a) Replace if damaged—(coil tube cracked or wires broken loose).
   - (b) Replace if weak or broken down (dead) —evidenced by weak or no spark at plug. (Do not confuse with defective condenser —be sure condenser is O.K. before judging coil defective.)

5. Flywheel.
   - (a) Replace if magnet is cracked.
   - (b) Replace if hub is damaged.

☆

CARBURETOR

1. High Speed Needle.
   - (a) Replace if seat is damaged or otherwise unfit for use as result of damage.
2. Low Speed Needle.
   - (a) Replace if seat is damaged or otherwise unfit for use as result of damage.

3. Float Valve.
   - (a) Rub in to properly seat if flooding of carburetor prevails, by grasping stem, and pulling up at same time turning back and forth between fingers.
   - (b) Replace if worn or damaged (bent) to extent carburetor is constantly flooding (overflowing).
4. Float.
   - (a) Replace if gasoline-soaked (float becomes heavy and does not function properly to result in flooding of carburetor).
   - (b) Replace if damaged.
5. Jets.
   - (a) Replace if damaged.
6. Primer—(Carburetor).
   - (a) Plunger.
     1. Replace if damaged or unfit for use.
     2. Replace plunger cups if worn or damaged.
   - (b) Spring—replace if weak or broken.
   - (c) Check valve—is on plunger—rub in seat, if gasoline flows through primer jet.

☆

"Y" VALVE

1. Thread Protector Chains.
   - (a) Replace if broken.
2. Thread Protectors.
   - (a) Replace if broken or damaged.
3. Hose Connections.
   - (a) Replace if threads are damaged or broken or cracked.
4. Rubber Seal Ring (in hose connection).
   - (a) Replace if broken, torn or lifeless.
5. Seal.
   - (a) Replace if broken or otherwise damaged. Note seat surface which bears against ball valve—this surface must be free of breaks or cracks.
6. Cover.
   - (a) Replace if broken, cracked or warped.
7. Packing Seal (in cover).
   - (a) Replace if worn or damaged.
8. Valve.
   - (a) Replace if broken or damaged.
   - (b) Replace if valve is damaged to affect loss of prime seal.
9. Valve Housing (body).
   - (a) Replace if broken, cracked or otherwise damaged.
10. Gaskets.
   - (a) Replace all gaskets—use old gaskets only in emergency.

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PUMP

1. Pump Housing.
   - (a) Replace if broken, cracked, if threads are stripped or otherwise damaged beyond practical repair.
2. Carbon Seal.
   - (a) Replace if damaged or if worn (this is important—damaged or worn seal will affect priming of pump—seal must be tight and free of leaks).
3. Check Valves.
   - (a) Replace if leaks are present or are damaged beyond repair.
4. Impeller.
   - (a) Replace if damaged, or worn beyond use.
5. Pump Housing Head.
   - (a) Replace if broken, sprung or cracked.
   - (b) Replace if threads are damaged beyond repair.
   - (c) Replace if worn beyond use.
6. Gaskets.
   - (a) Replace—always use new gaskets except in emergency.

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PRIMER (Pump)

1. Cylinder.
   (a) Replace if damaged (dented) or if bore is excessively scored.
   (b) Replace if threads are stripped beyond repair.
2. Cap.
   (a) Replace if broken, sprung or if threads are stripped.
3. Shaft.
   (a) Replace if bent or damaged beyond repair.
4. Plunger Discs.
   (a) Replace if damaged.
5. Plunger Washers.
   (a) Replace if worn or damaged.
6. Check Valve.
   (a) Replace if seals are damaged to extent of leaking.

* * *

   (b) Replace ball check if worn to point where satisfactory seal cannot be maintained.

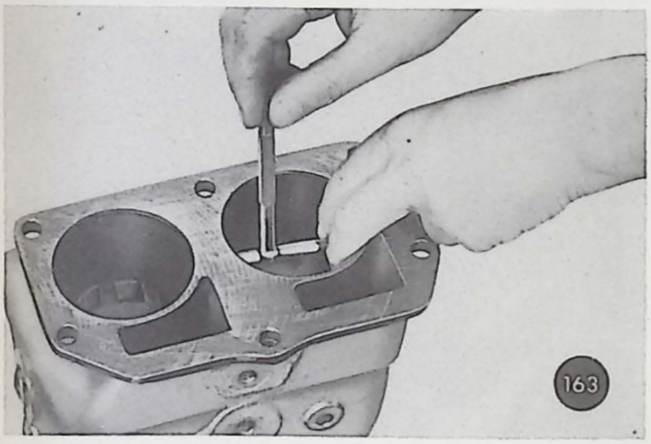
ENGINE

1. Cylinder Heads.
   (a) Replace if broken, cracked or warped.
   (b) Replace if spark plug threads are stripped.
2. Cylinders.
   (a) Replace if broken, cracked (as result of freezing) or worn excessively. Cylinder is ground to 2.750-2.751 at factory.
   (b) Replace if cylinder walls are deeply scored or otherwise damaged.
   (c) Scrape carbon from top end of stroke. Do not scrape on active part of cylinder.
   (d) Scrape carbon from ports. If cylinder is burred at edge of ports, remove burr before putting piston in cylinder, or before turning flywheel and moving piston in cylinder.
3. Piston Rings.
   (a) Replace if broken.
   (b) Replace if worn—normal piston ring gap is .008″ to .015″. If ring gap is in excess of .020″, install new ring—but be sure first the cylinder bore is not worn since diameter of cylinder affects ring gap as well.
4. Piston.
   (a) Replace if broken, cracked or out of round, also, if ring grooves are damaged, or if sticking, rings cannot be removed without damage to ring seats.
   (b) Replace if wrist pin holes are worn to a point where wrist pin fits loosely. Pin should fit snugly—a light drive or slip fit.
   (c) Replace if wrist pin retainer grooves are damaged to a point where retainers are apt to dislodge while unit is in operation. Result is damage to cylinder walls.
5. Wrist Pins.
   (a) Replace if worn—indicated by fit in piston—should be light drive.
6. Wrist Pin Retainers.
   (a) Replace if damaged.
   (b) Replace if spring tension is too weak to hold retainers fast in piston.
7. Connecting Rod.
   (a) Replace if damaged—broken or bent.
   (b) Replace if wrist pin bushing is worn.
   (c) Replace if diameter of large end of connecting rod is worn, pitted, or rusted.
8. Connecting Rod Screws.
   (a) Replace if damaged or bent.
9. Connecting Rod Rollers.
   (a) Replace if rusty, pitted or otherwise damaged.
10. Crankshaft.
   (a) Replace if bent or otherwise damaged (damaged threads, keyways or tapers on both ends).
   (b) Replace if crankpins are worn or if there are signs of the crank pins breaking down—as indicated by small cracks, pits or has appearance of porosity.
   (c) Replace if crank pins or center journal are sufficiently rusted to cause failure of bearing.
11. Center Head.
   (a) Replace if damaged.
   (b) Rollers and bearing race.
      1. Replace if rusted or pitted.

12. Carbon Seals.—Crankcase head (pump end) and pump housing.—Oil and Pressure seal.
    (a) Replace if damaged or worn—identified by water or oil dripping from holes in pump housing (if water drips, pump seal should be replaced—if oil drips, crank case seal should be replaced).
13. Gaskets.
    (a) Replace all gaskets with new ones—don't use old gaskets except in emergency.

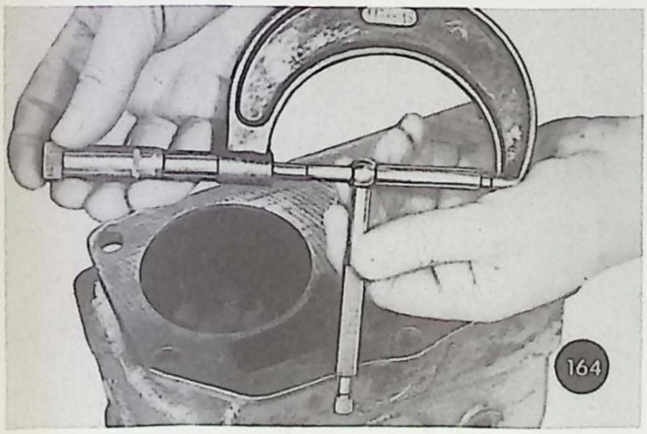
TO CALIPER CYLINDER BORE

The cylinder walls in time will wear, depending on actual running time of the engine or as result of negligence when mixing fuel to result in faulty lubrication.



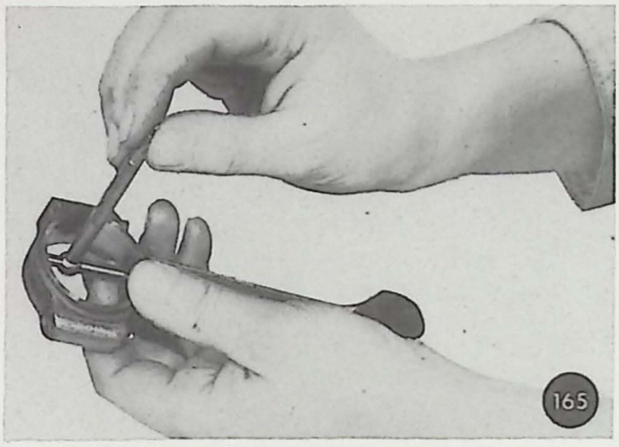
Calipering Cylinder Bore

Maximum wear will occur in area of piston ring travel, thus when checking bore for size, the cylinder must be calipered accordingly. Unless an inside micrometer caliper is available, use a telescope gauge as shown in Fig. 163. Insert gauge into area of ring travel, loosen knob at end of gauge handle to permit telescoping element to bear against opposite wall—(gauge must be square with cylinder bore to accurately caliper) tighten knob on handle. To obtain actual measurement of bore, caliper the gauge with outside micrometer as shown, Fig. 164. Measurements should be taken from several positions in bore to determine amount of wear, out of round, taper, etc. If wear or out of round exceeds .003", replace cylinder. Basic diameter of cylinder bore is 2.750. Slight variations will be found due to manufacturing tolerances.

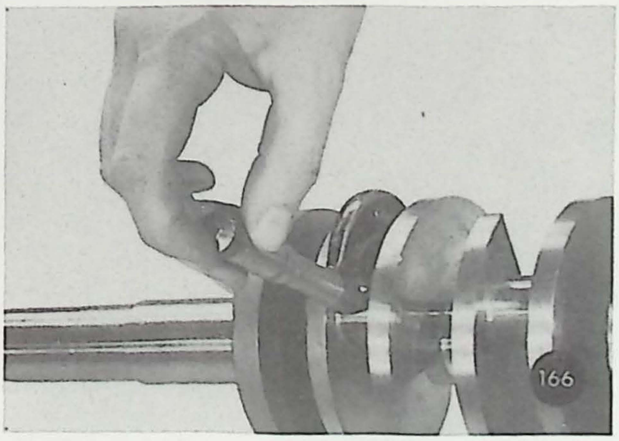


Calipering Telescope Gauge

* * *



Illustrating method of checking connecting rod for wear, using a telescope gauge. Finish grind size on new rod is 1.500". If excessively worn, pitted or rusted replace with new rod.



Showing method of checking crankshaft, crank pin, for wear with micrometer caliper. Finish grind size on new shaft is 1.000". If out of round, pitted, or worn to extent where grooves appear, replace with new crankshaft.

NOTES

JOHNSON

MODEL P-500 PUMP

SECTION VI

PARTS LIST

☆

HOW TO ORDER PARTS

This section of manual consists of three parts, namely, (1) illustrations with part numbers identifying each part, (2) a numerical list of detail parts and assemblies and (3) a break-down of assemblies.

Illustrations include the (1) magneto, (2) carburetor, (3) cylinder, crankcase and muffler group, (4) crankshaft, rod and piston group, (5) crankshaft, (6) pump, (7) receiver, (8) "Y" valve, pressure regulator, (9) hand primer, (10) fuel filter, (11) frame and panel group.

Parts consisting of several pieces bolted or otherwise fastened together are termed assemblies, while parts made of but one piece, such as nuts, washers, piston rings, etc., are designated as detail parts.

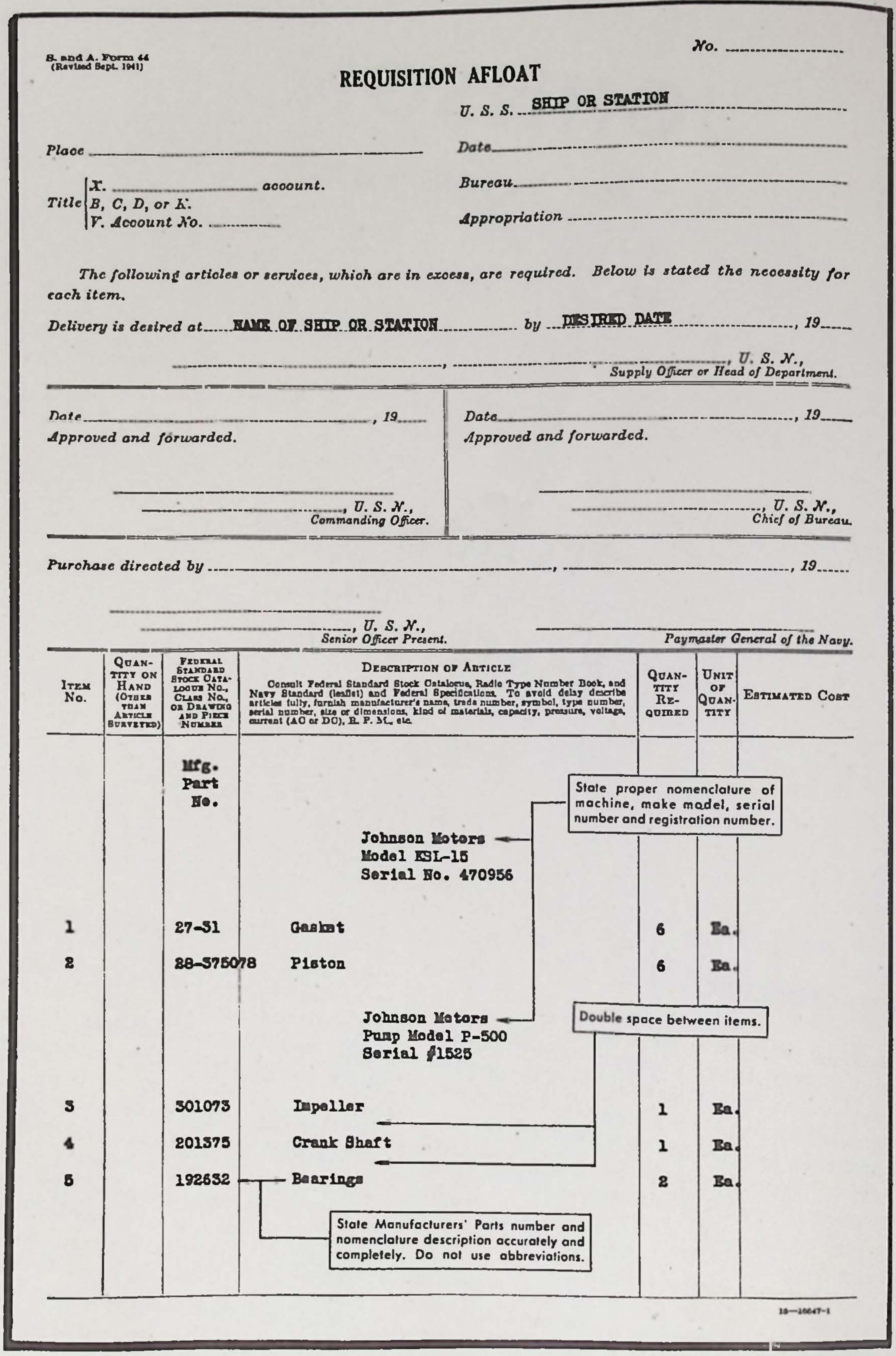
Detail parts are placed at head of the list followed by the assemblies in numerical sequence.

The assembly break-down list includes part number of each assembly and a list of parts (under subheading) which go to make up the assembly. NOTE—Parts in sub-headings prefixed with an * and provided with no part number cannot be purchased separately as a service part.

When ordering, refer to illustrations—magneto if magneto parts are required. Note part number identifying part to be ordered. Refer to numerical list for description of part and list price each. Order accordingly through regular Navy channels.

SEE SAMPLE REQUISITION

SAMPLE REQUISITION



S. and A. Form 44
(Revised Sept. 1941)

No. ....

REQUISITION AFLOAT

U. S. S. SHIP OR STATION

Place ....

Date ....

Title | *X.* .... *account.*
B, C, D, or K.
V. Account No. ....

Bureau ....

Appropriation ....

The following articles or services, which are in excess, are required. Below is stated the necessity for each item.

Delivery is desired at NAME OF SHIP OR STATION *by* DESIRED DATE, *19*....

...................., ..., *U. S. N.,*
Supply Officer or Head of Department.

Date ...., *19*....
Approved and forwarded.

...................., *U. S. N.,*
Commanding Officer.

Date ...., *19*....
Approved and forwarded.

...................., *U. S. N.,*
Chief of Bureau.

Purchase directed by ...., ..., *19*....

...................., *U. S. N.,*
Senior Officer Present.

....
Paymaster General of the Navy.

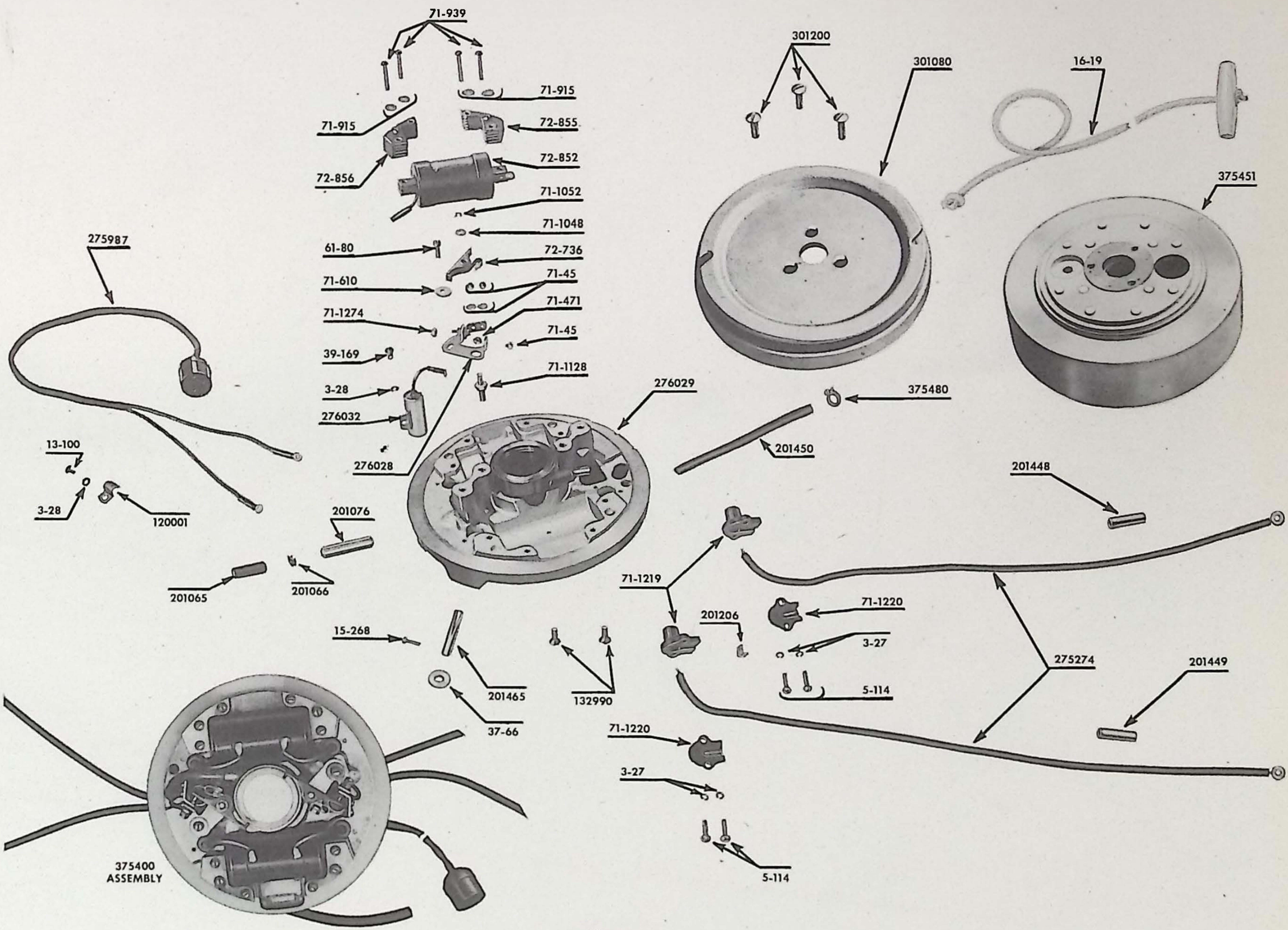
Item No.	Quantity on Hand (Other than Article Surveyed)	Federal Standard Stock Catalogue No., Class No., or Drawing and Piece Number	Description of Article Consult Federal Standard Stock Catalogue, Radio Type Number Book, and Navy Standard (leaflet) and Federal Specifications. To avoid delay describe articles fully, furnish manufacturer's name, trade number, symbol, type number, serial number, size or dimensions, kind of materials, capacity, pressure, voltage, current (AC or DC), R. P. M., etc.	Quantity Required	Unit of Quantity	Estimated Cost
		Mfg. Part No.				
			Johnson Motors Model KSL-15 Serial No. 470956			
1		27-31	Gasket	6	Ea.	
2		28-375078	Piston	6	Ea.	
			Johnson Motors Pump Model P-500 Serial #1525			
3		301073	Impeller	1	Ea.	
4		201375	Crank Shaft	1	Ea.	
5		192532	Bearings	2	Ea.	

State proper nomenclature of machine, make model, serial number and registration number.

Double space between items.

State Manufacturers' Parts number and nomenclature description accurately and completely. Do not use abbreviations.

10—16647-1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16-19
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72-852
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39-169
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3-28
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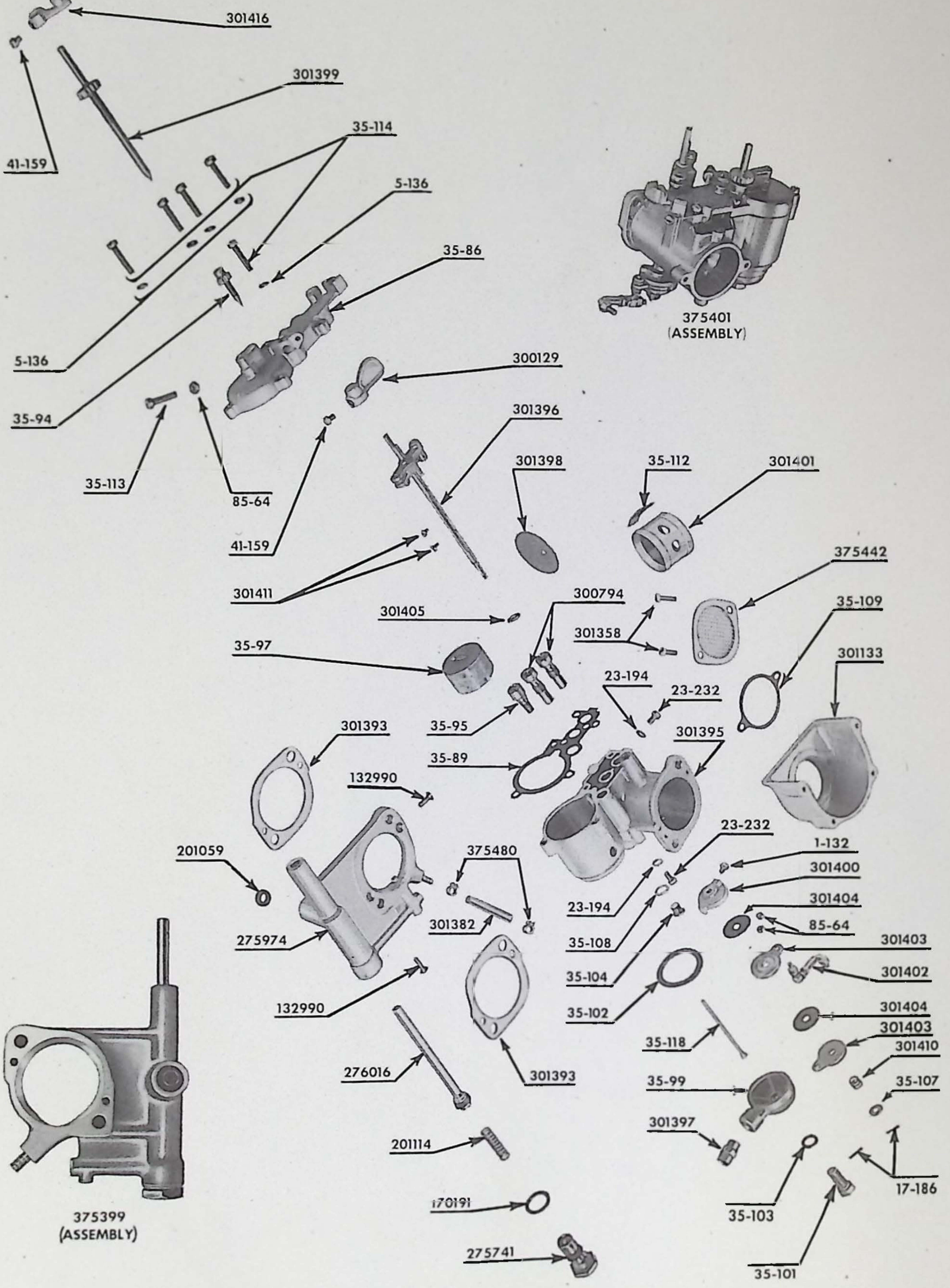
276029
375480
276028
201450
13-100
201448
3-28
120001
201076
71-1219
201065
201066
71-1220
201206
15-268
3-27
275274
201449
132990
5-114
201465
37-66
71-1220
3-27
5-114
375400
ASSEMBLY

Magneto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301393
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35-103
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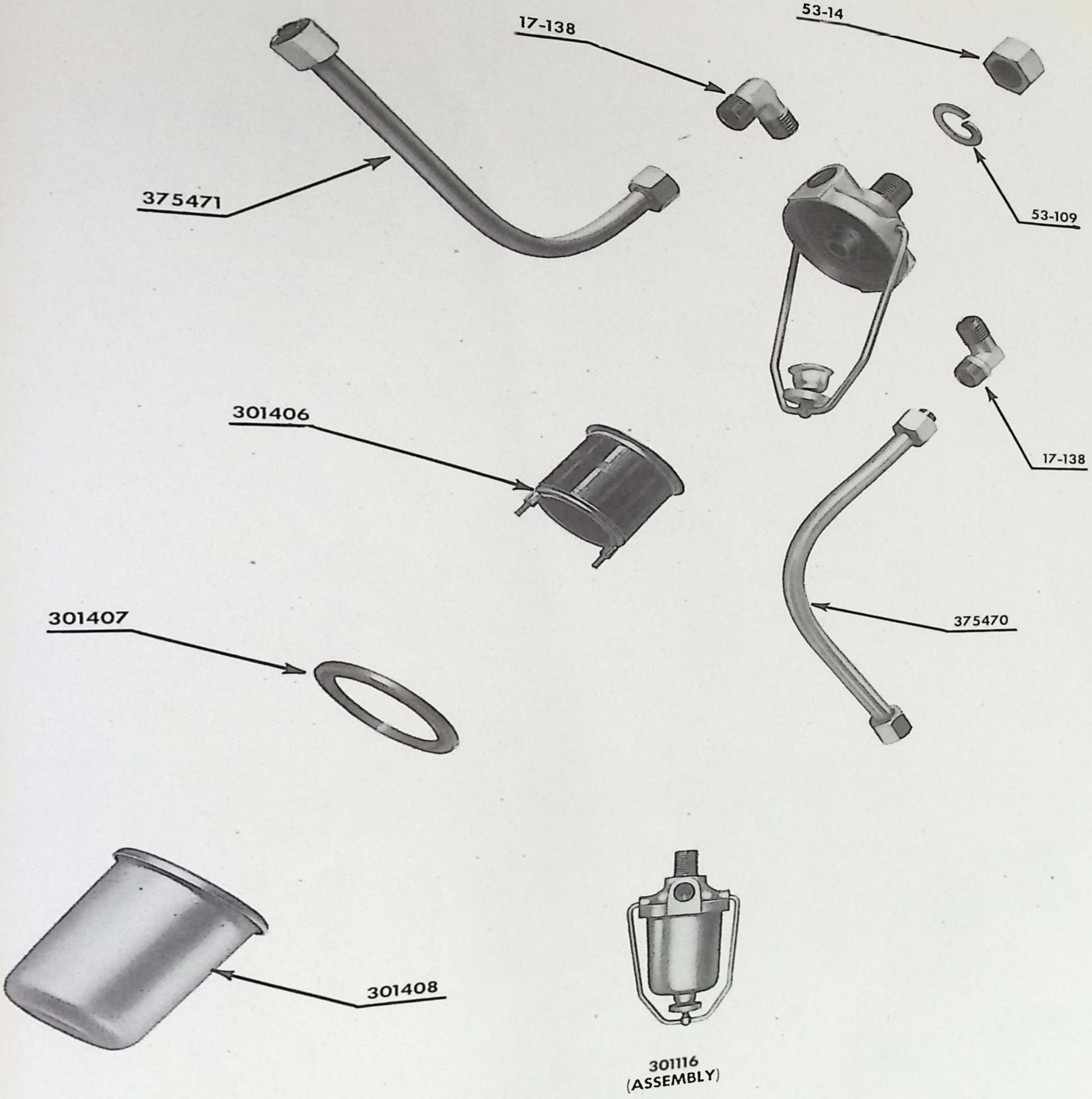
35-101

Carburetor—Primer Assembly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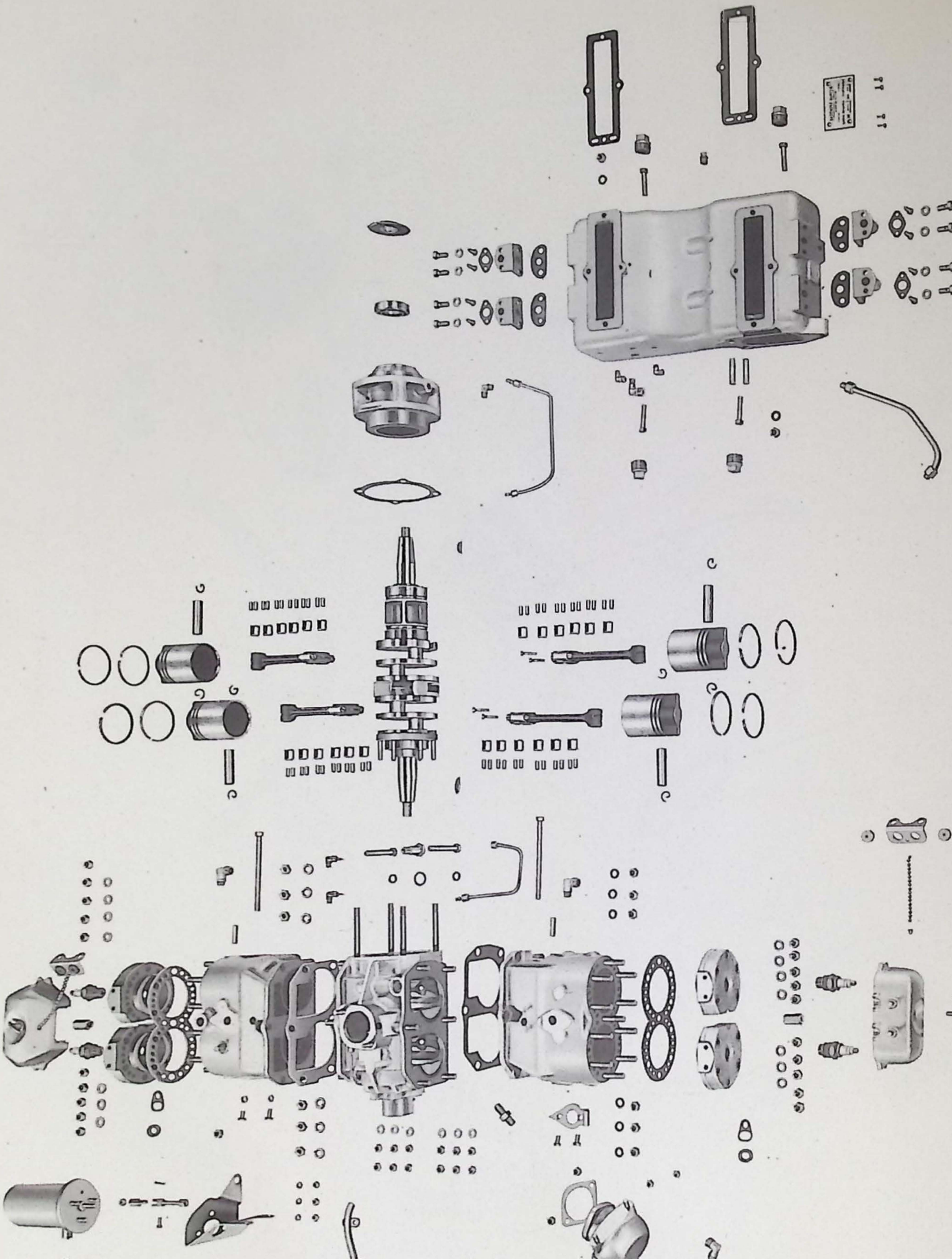
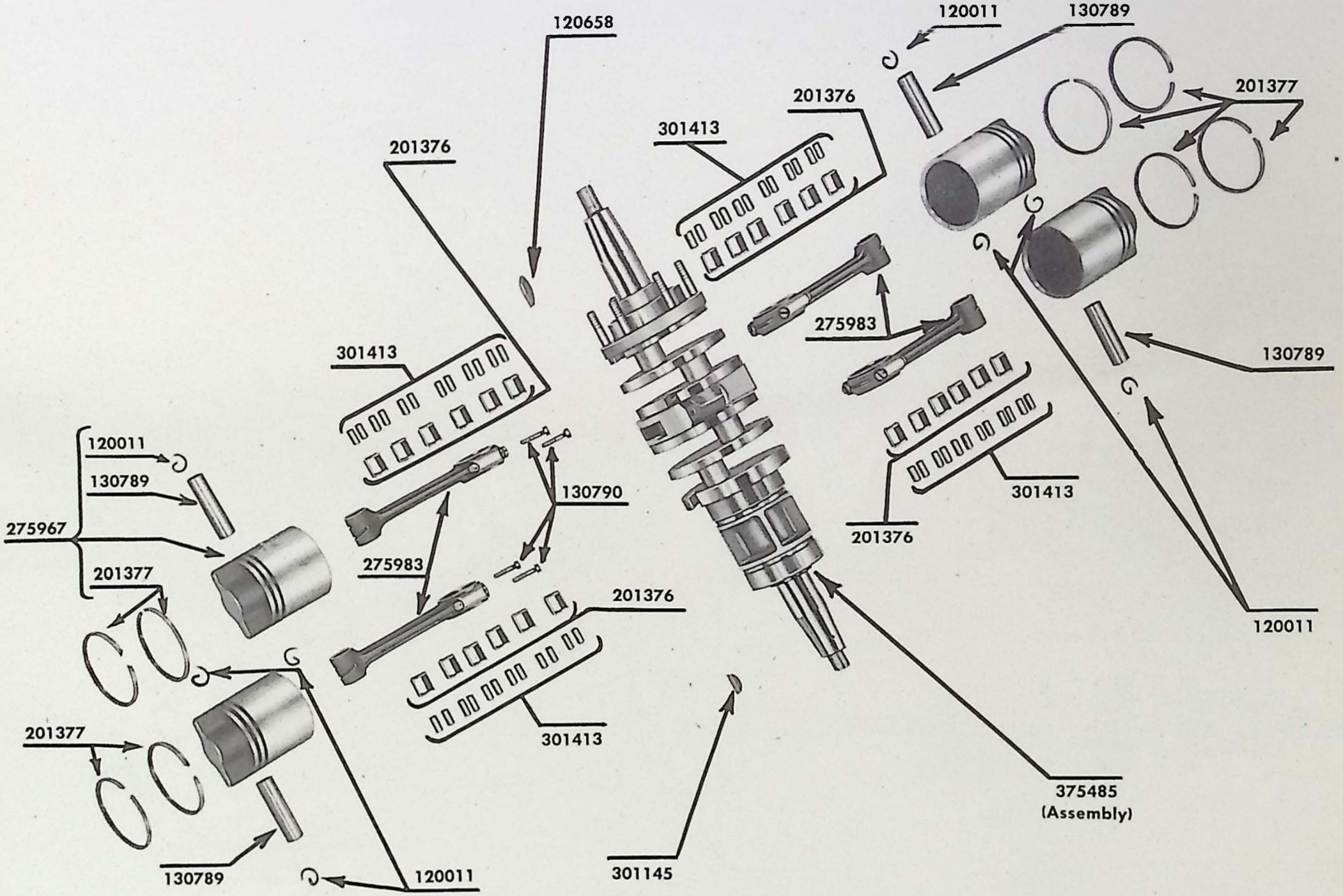
Fuel Filter



Engine and Muffler Assembly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201376
301413
201376
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(Assembly)
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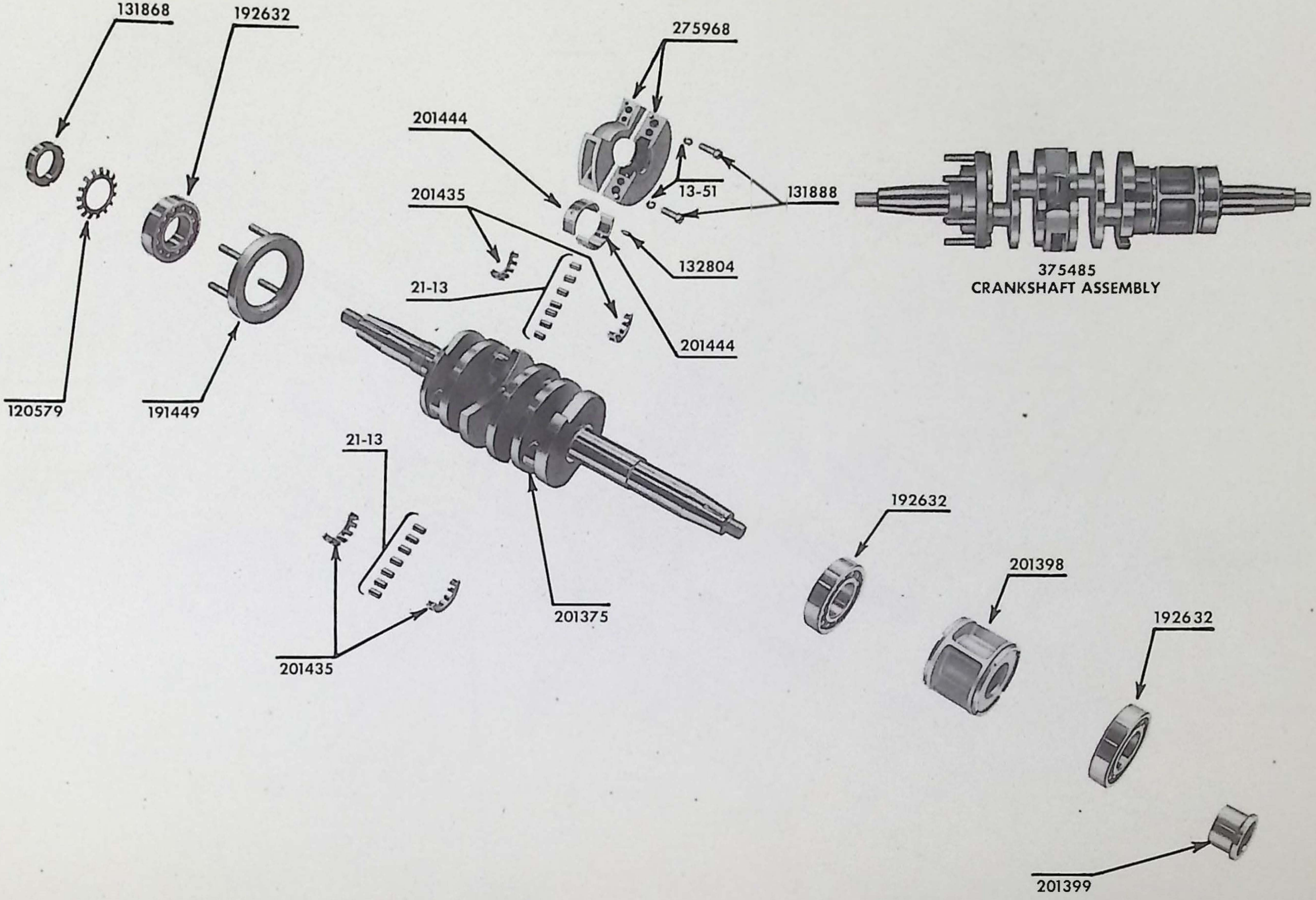
Crankshaft, Piston and Rod Assembly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CRANKSHAFT ASSEMBLY
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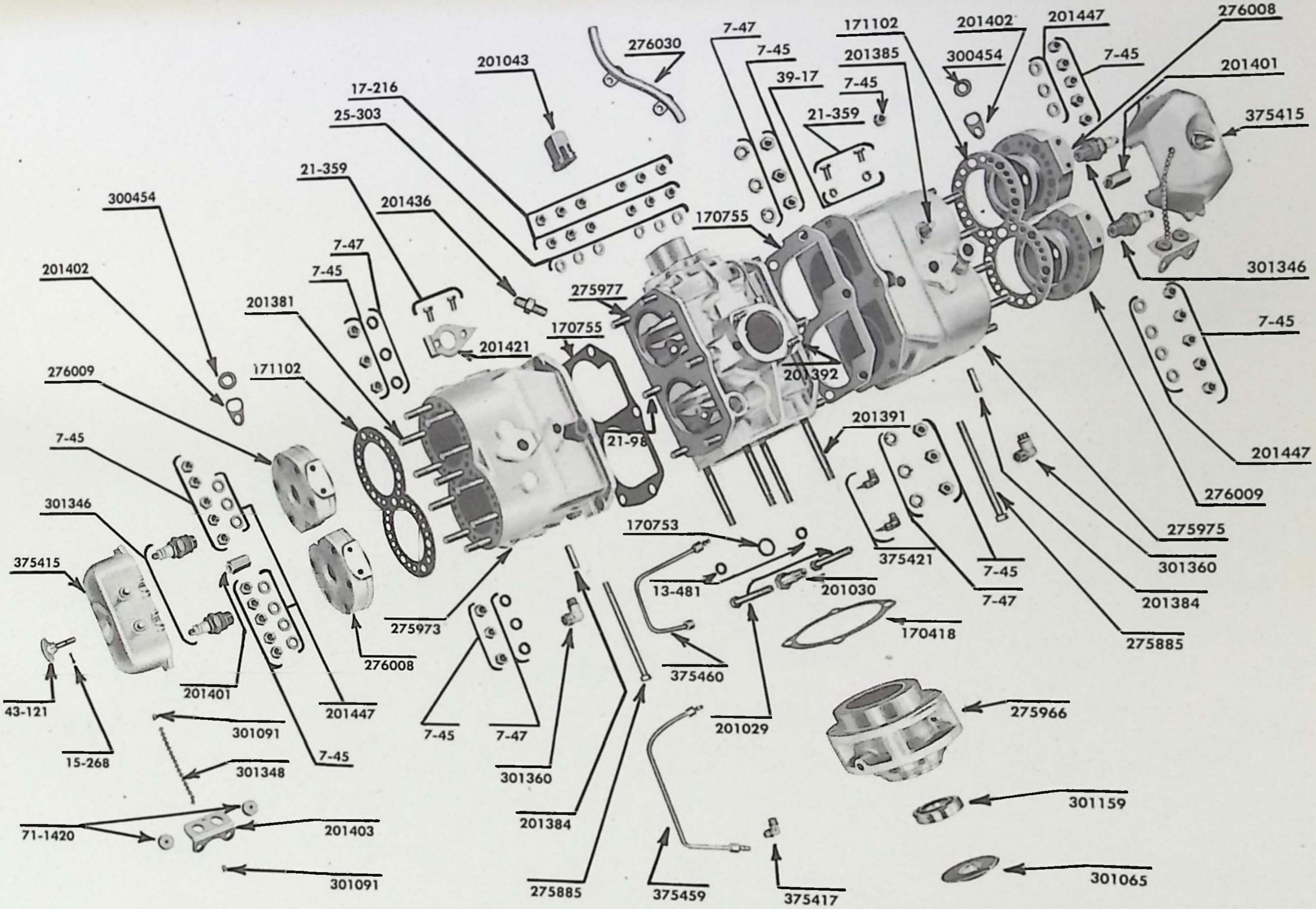
Crankshaft Assembly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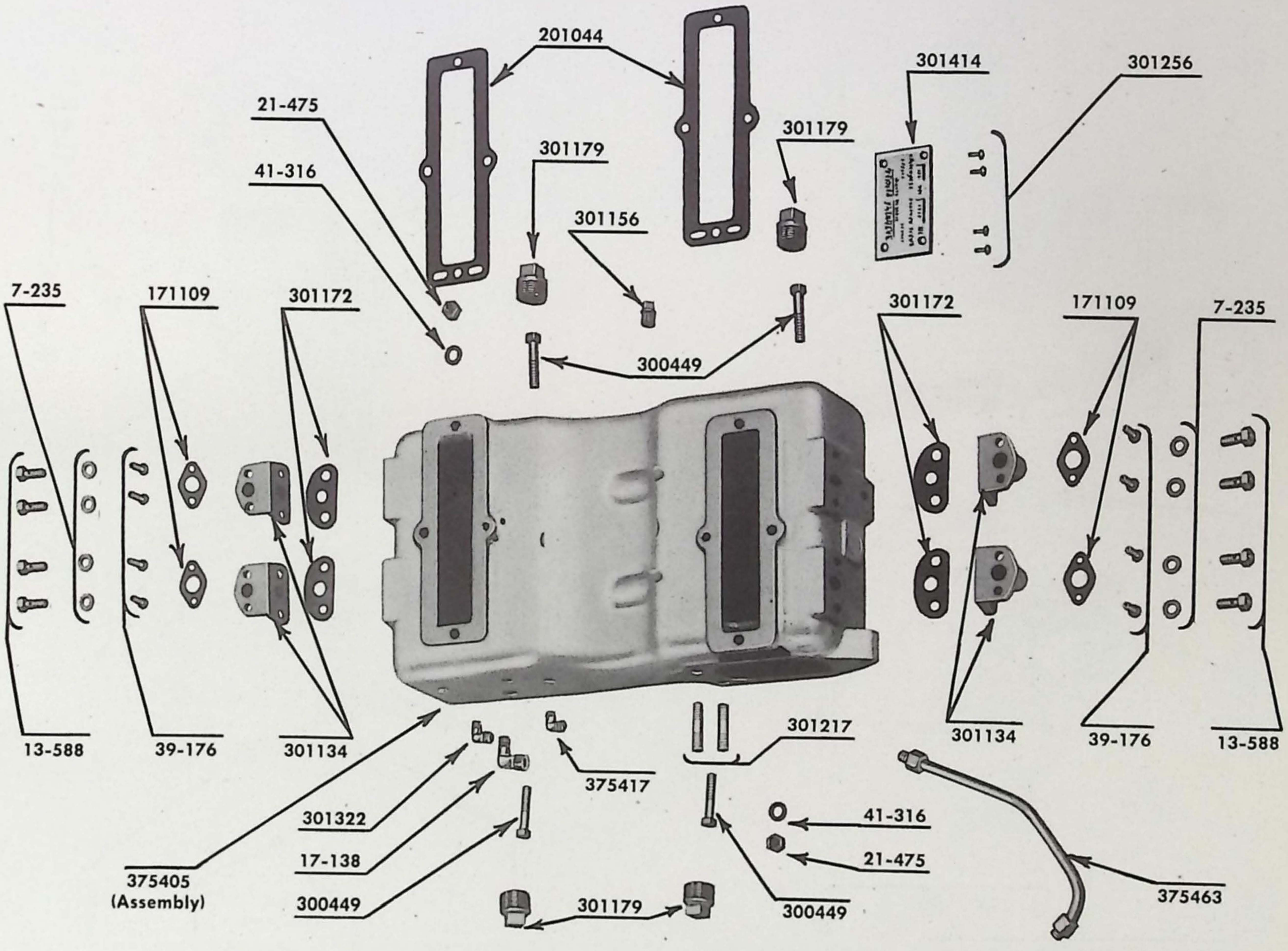
Cylinder and Crankcase Group

NOTES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17-138
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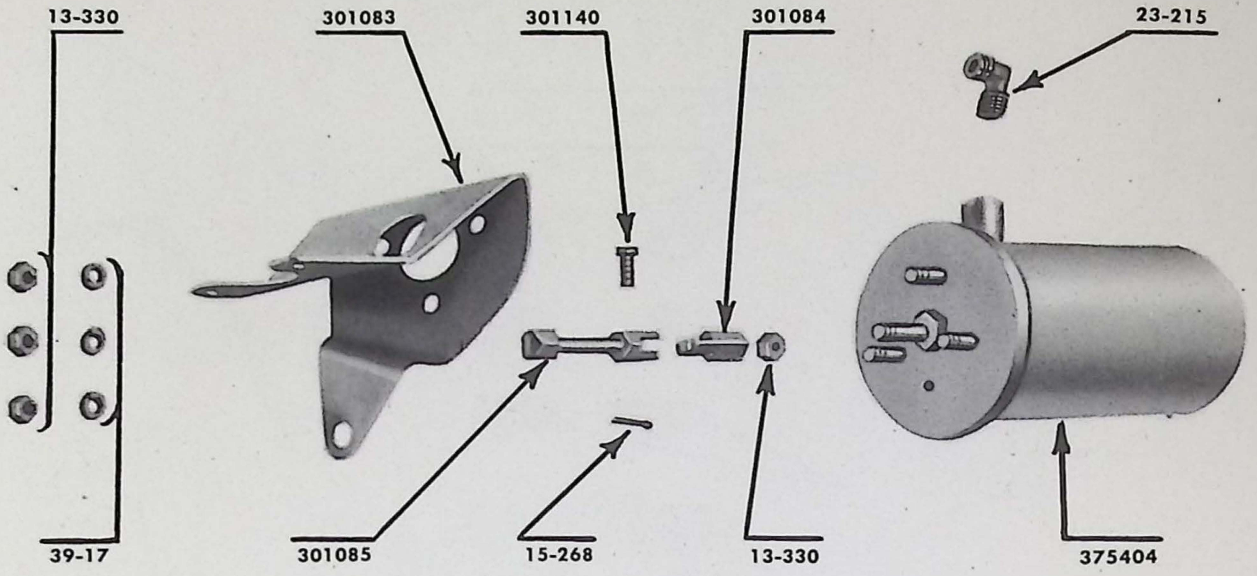
Muffler Assembly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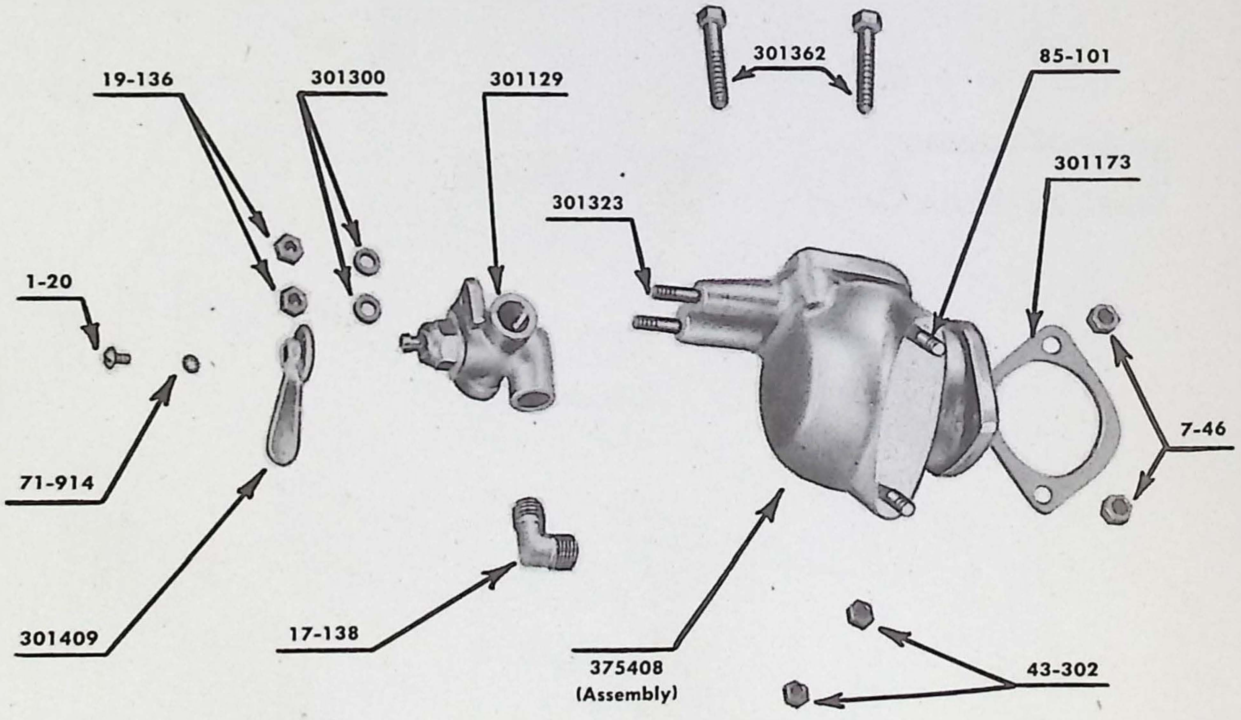
Control Cylinder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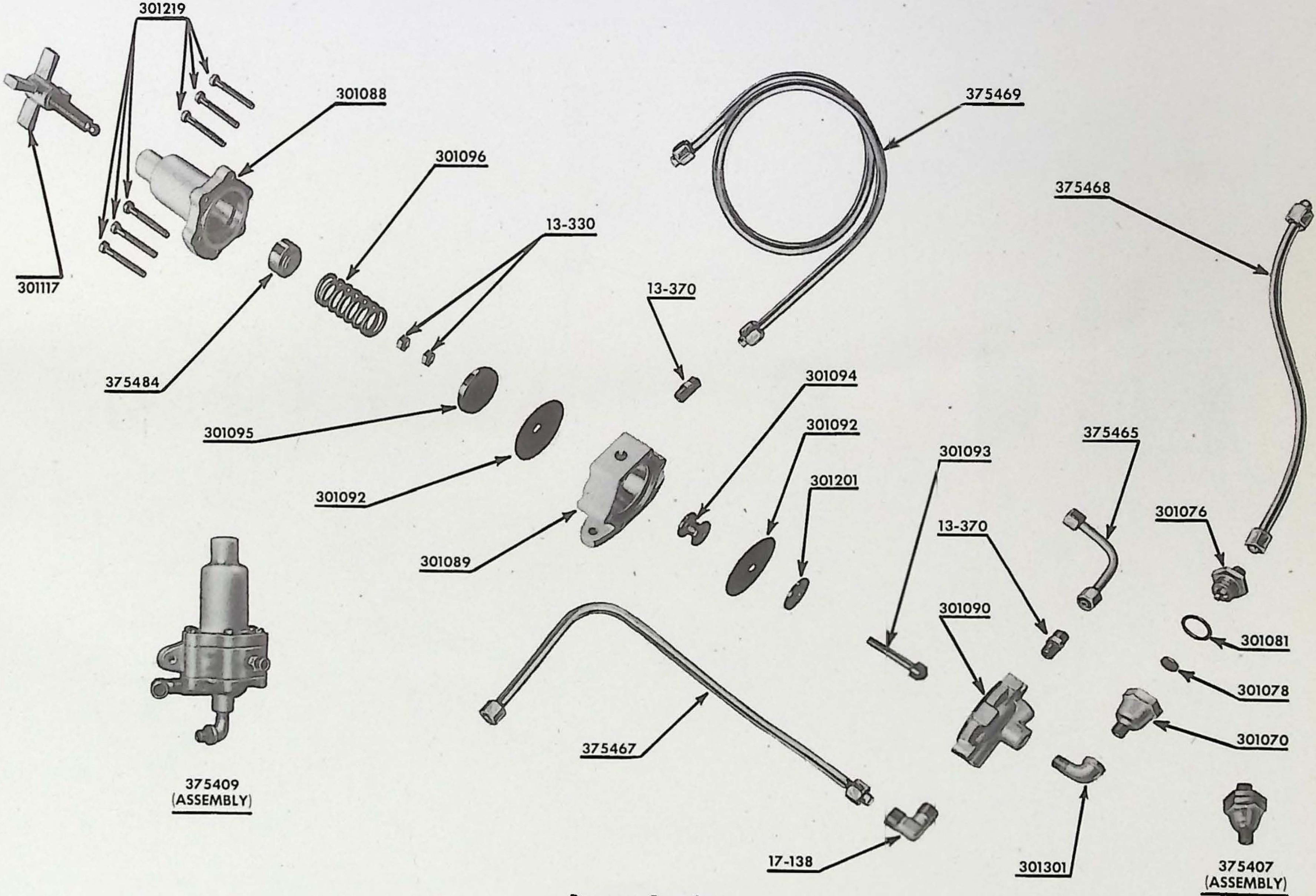
(Assembly)
43-302

Manifold and Fuel Valve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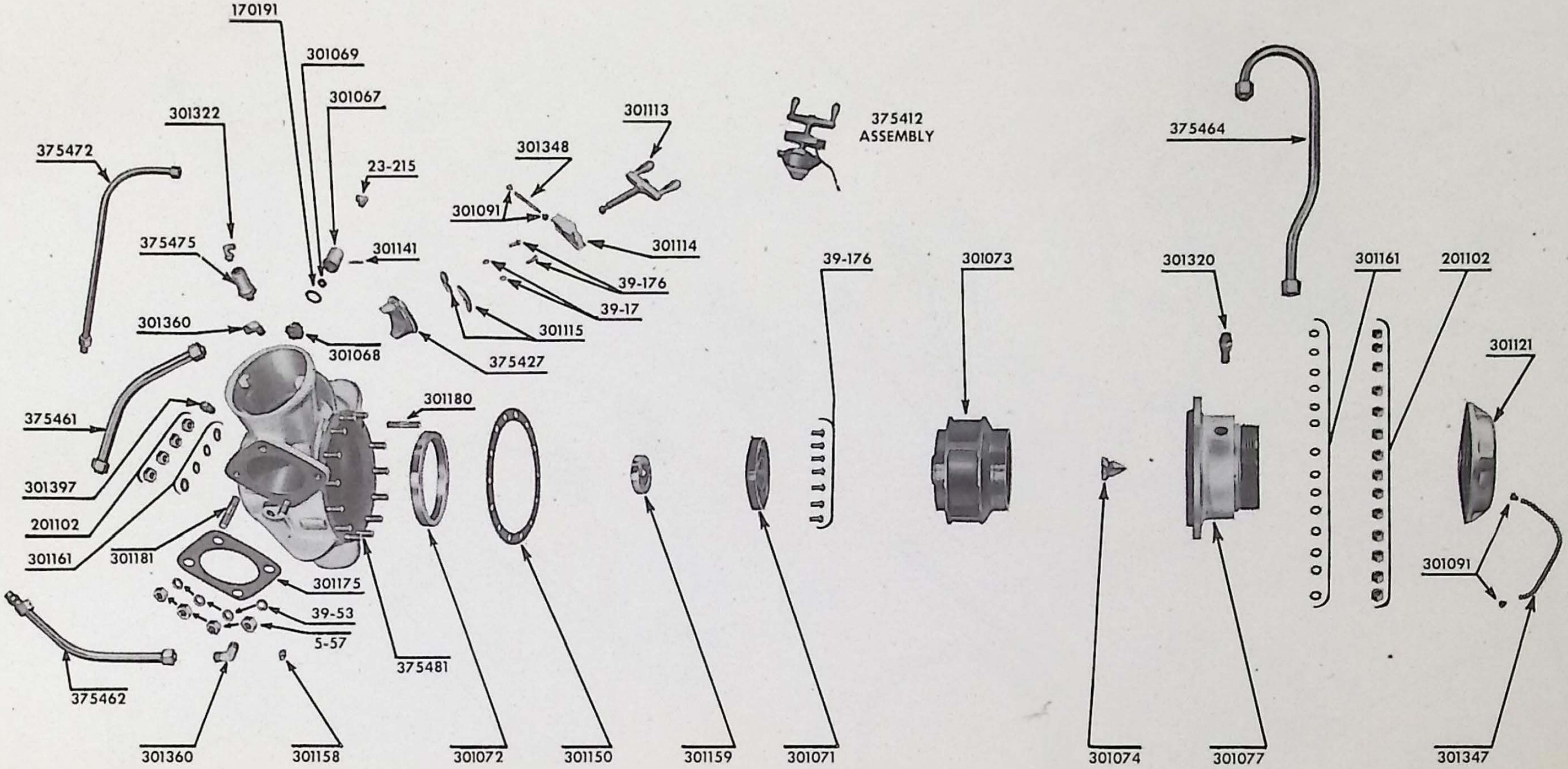
(ASSEMBLY)

Pressure Regulator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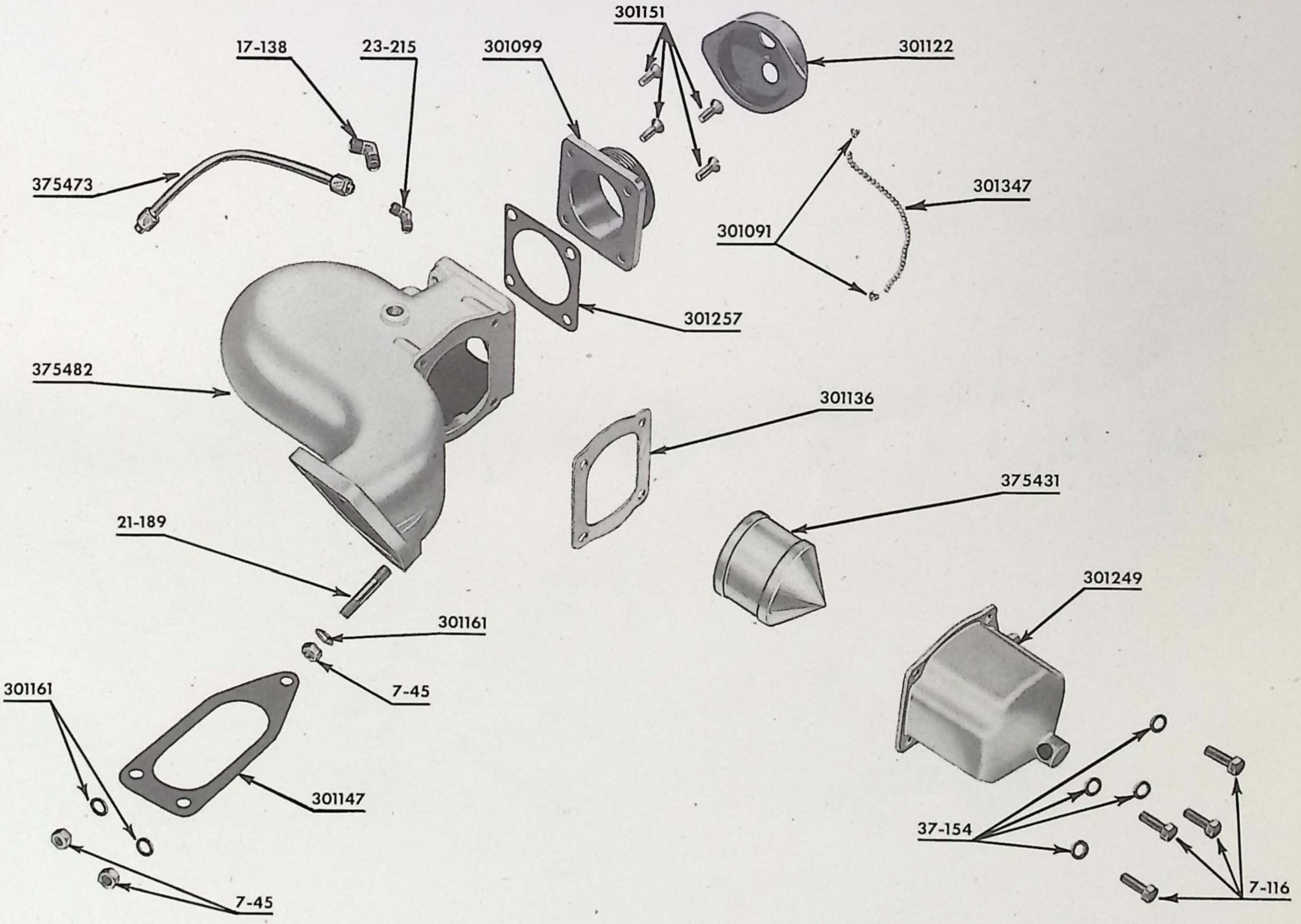
Pump Assembly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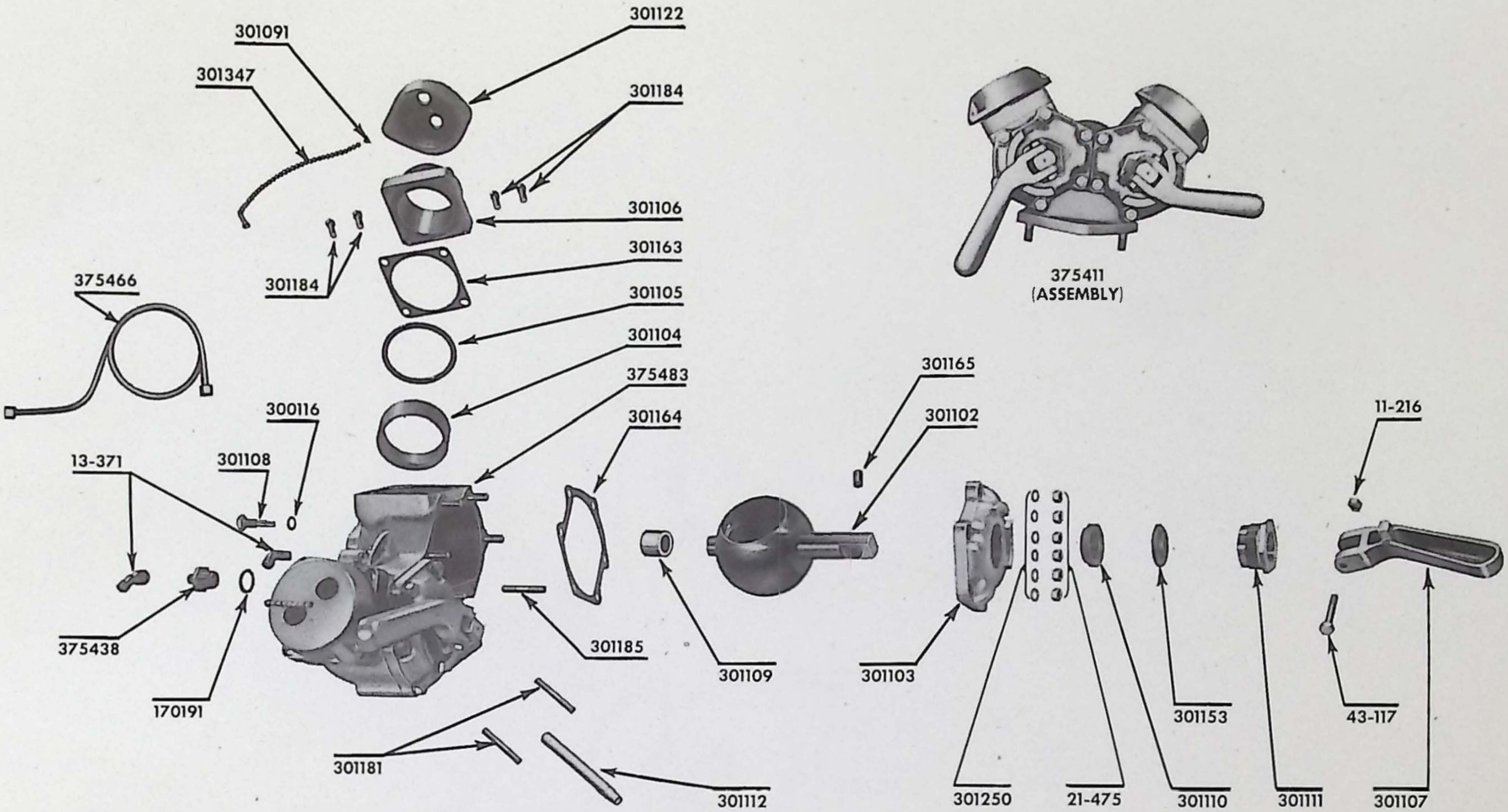
7-45

Receiver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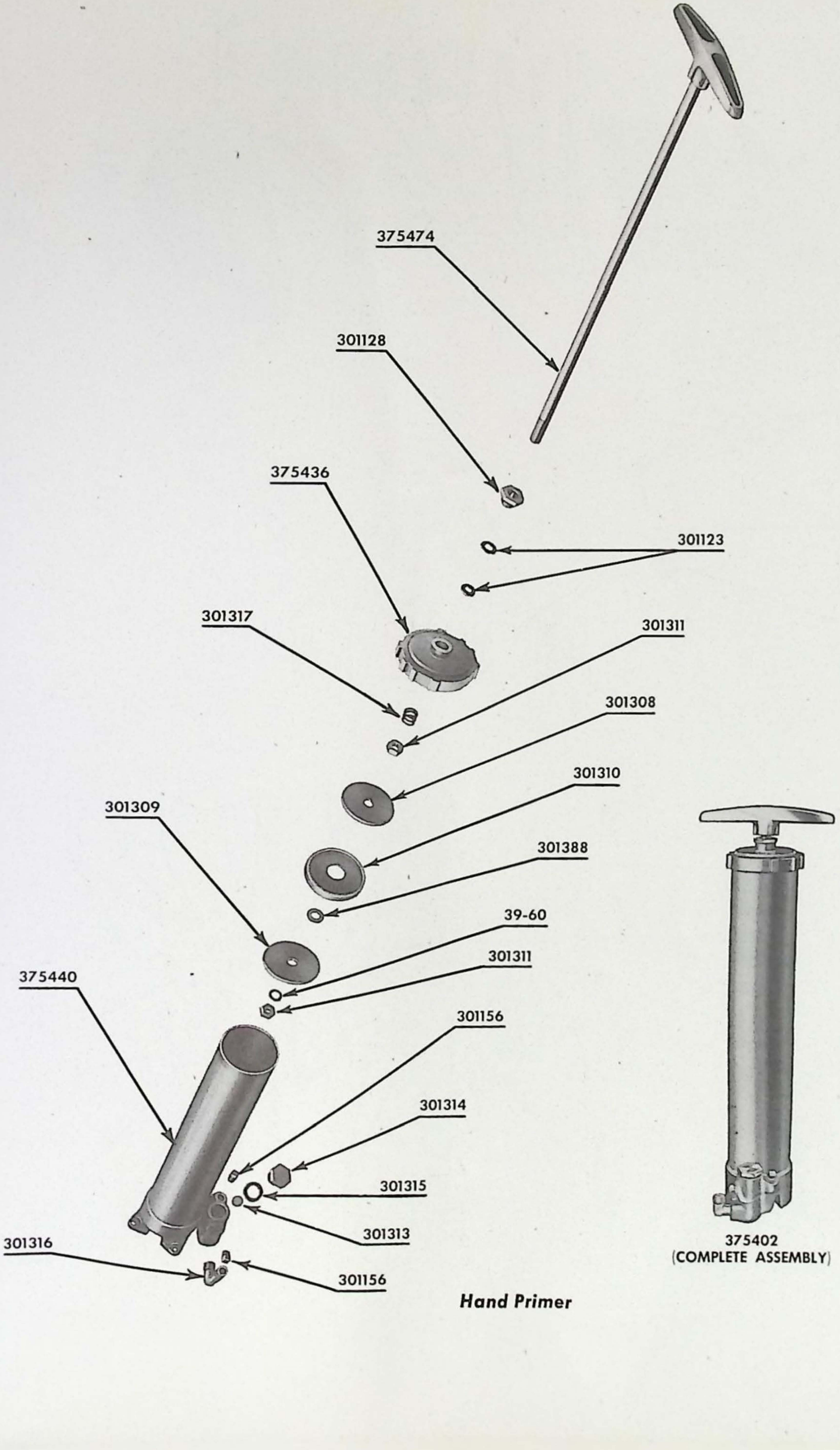
301107

Y-Valve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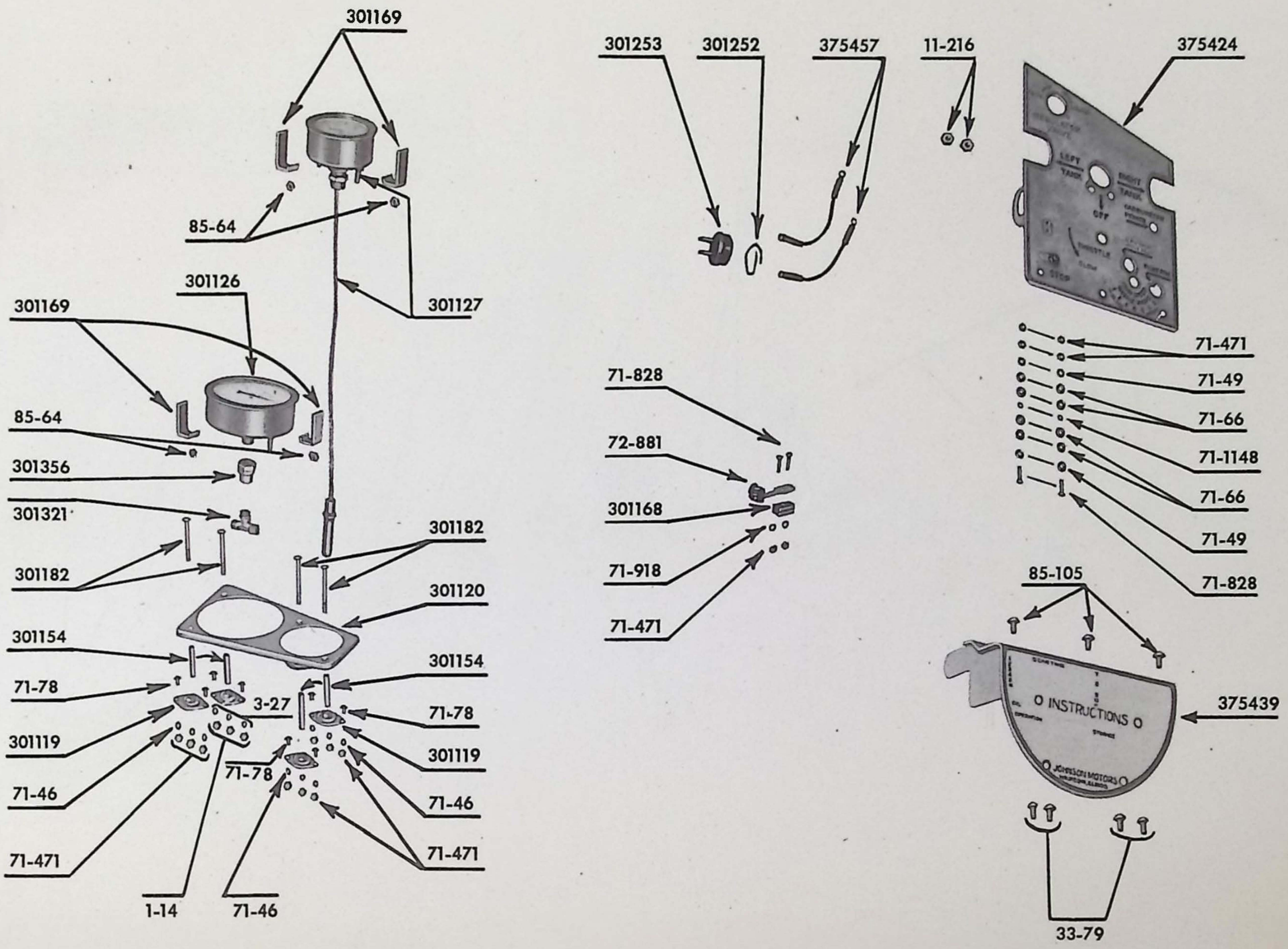
301316
301156

375402
(COMPLETE ASSEMBLY)

Hand Primer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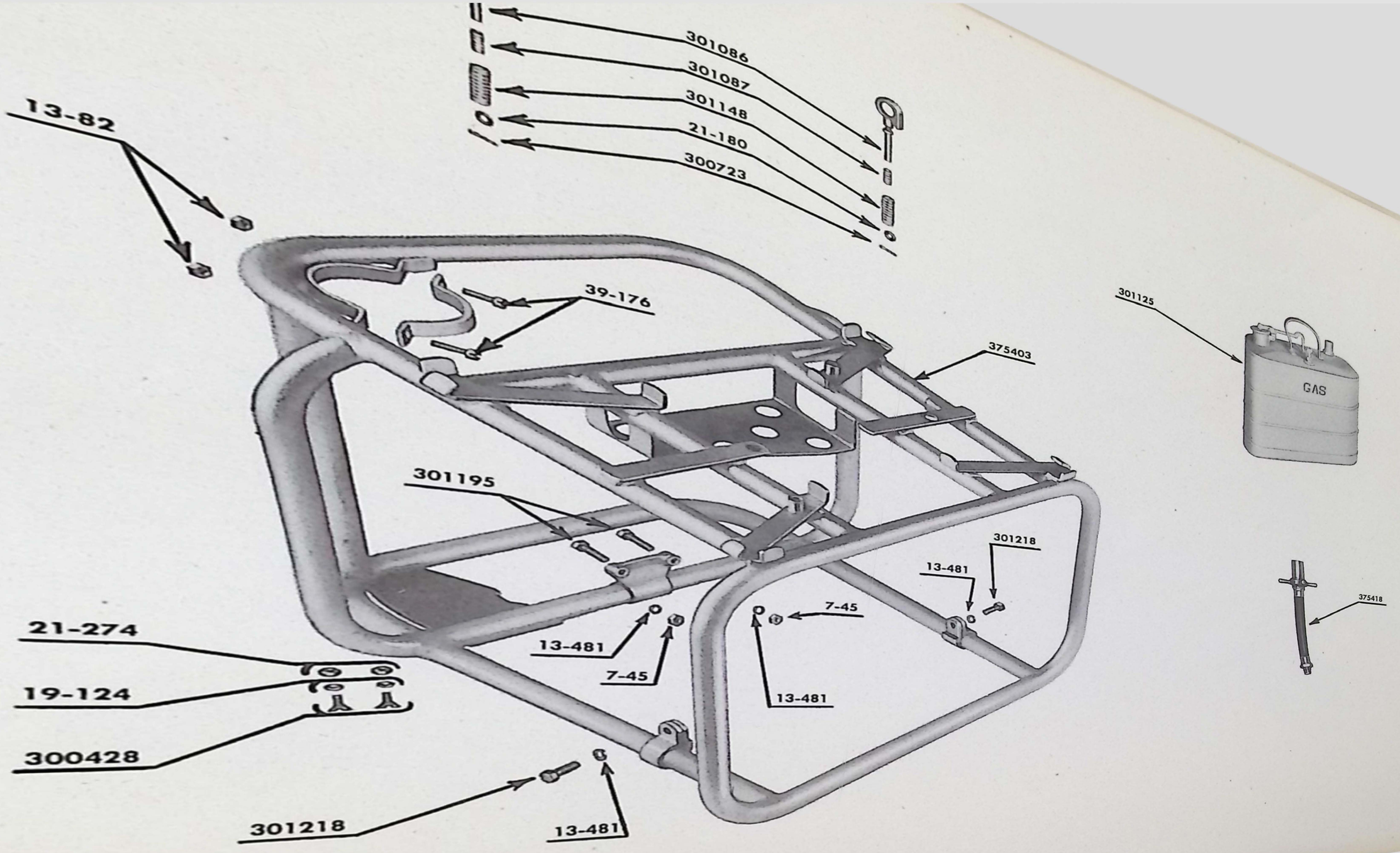
RIGHT TANK
OFF
THROTTLE
STOP
INSTRUCTIONS
JOHNSON MOTORS

Gauge and Panel Group

NOTES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13-481
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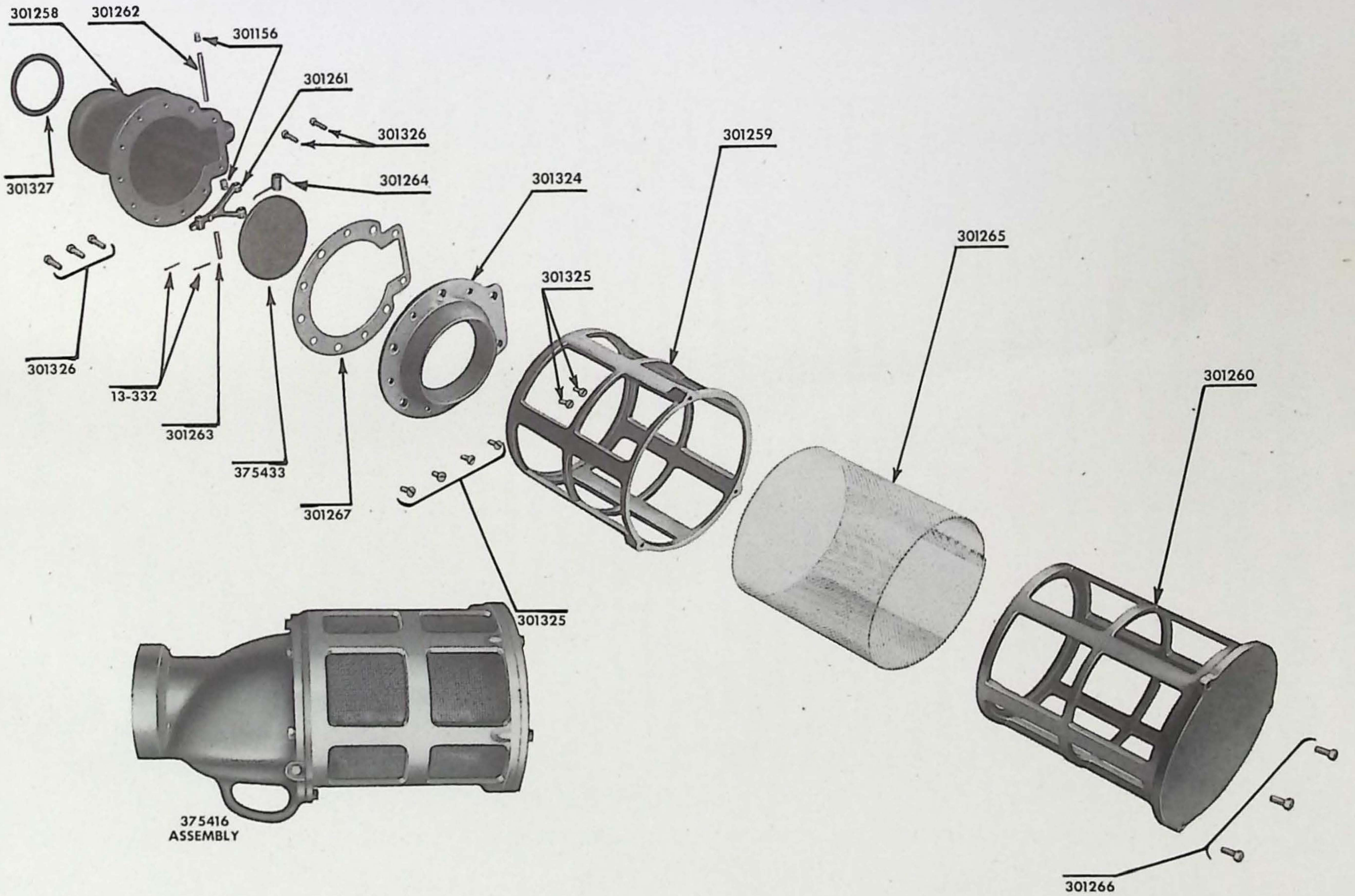
13-481

Frame and Fuel Tank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301267
301260
301325
375416
ASSEMBLY
301266

Foot Valve

NUMERICAL PARTS LIST
FOR JOHNSON MODEL P-500 PUMP

PART NO.	NO. REQ.	DESCRIPTION	MATERIAL	UNIT LIST PRICE
1-14	4	Nut, Gauge Panel to Rubber Mounting	Brass	.025
1-20	1	Screw—Handle to Fuel Valve	Brass	.025
1-132	1	Screw—Carburetor	Brass	.025
3-27	12	Lockwasher—Gage Panel—Rubber Mounting and Screw for High Tension Cable Clamp	Steel	.025
3-28	3	Lockwasher—Condenser Screw and Cutout Lead Clampscrew	Steel	.025
5-57	4	Nut—"Y" Valve to Pump Housing	Steel	.10
5-114	8	Screw—High Tension Cable Clamp	Steel	.025
5-136	5	Lockwasher—Float Bowl Cover—Carburetor	Steel	.025
7-45	18	Nut—Frame Bracket to Pumping Housing, Bracket to Cylinder, Receiver to Muffler and Cylinder to Crankcase Stud	Steel	.025
7-46	2	Nut—Elbow—Carburetor to Crankcase	Steel	.025
7-47	12	Lockwasher—Nut—Cylinder Stud	Steel	.025
7-116	4	Screw—Float Housing to Receiver	Steel	.10
7-235	8	Washer—Elbow to Muffler	Steel	.025
11-216	4	Nut—Panel to Elbow Assembly to Handle to Valve Stem—"Y" Valve	Steel	.15
13-51	2	Lockwasher—Center Bearing Screw—Crankshaft	Steel	.025
13-82	2	Nut—Primer to Base	Brass	.025
13-100	1	Screw—Cutout Lead Clamp	Brass	.025
13-330	6	Nut—Operating Cylinder to Bracket and Link—Valve Shaft	Bronze	.05
13-332	2	Pin—Cotter—Valve and Arm Pivot Pin	Brass	.025
13-370	2	Fitting—Tube to Pressure Regulator	Brass	.10
13-371	2	Elbow—"Y" Valve to Tee and Screen Assembly	Brass	.25
13-481	4	Lockwasher—Frame Bracket to Muffler	Steel	.025
13-588	8	Screw—Elbow to Muffler	Steel	.025
15-268	3	Pin—Cotter—Linkage Pin and Spark Plug Cover Screw	Bronze	.05
16-19	1	Rope—Starting	Wood and Cotton	.15
17-138	6	Elbow—Fuel Valve to Strainer, Water Inlet, Cooling, Receiver to Pressure Regulator, Strainer to Gas Line and Pressure Regulator Drain	Brass	.15
17-186	2	Pin—Cotter—Carburetor	Brass	.025
17-216	12	Nut—Jam—Clamp Ring Stud—Crankshaft	Steel	.025
19-124	2	Lockwasher—Primer to Base	Steel	.025
19-136	4	Nut—Pressure Regulator and Filter Valve to Carburetor (Elbow) Manifold	Steel	.025
21-13	14	Rollers—Center Bearing—Crankshaft	Steel	.10
21-98	12	Stud—Crankcase to Cylinder	....	.05
21-180	2	Washer—Gas Tank Hold Down Clamp	Brass	.025
21-189	1	Stud—Receiver to Muffler	Steel	.10
21-274	2	Nut—Primer to Base Screw	Steel	.025
21-359	4	Screws—Bracket to Cylinder—Side and Ignition Timing Pointer	Steel	.025
21-475	14	Nut—Muffler to Engine and Cap of Body—"Y" Valve	Steel	.10

PART NO.	NO. REQ.	DESCRIPTION	MATERIAL	UNIT LIST PRICE
23-194	2	Gasket—Fuel Passage Screw—Carburetor	Fibre	.05
23-215	3	Elbow—Operating Cylinder to Pressure Regulator, Ball Check Valve, Receiver and Water Connection to Receiver	Brass	.45
23-232	2	Screw—Fuel Passage—Carburetor	Steel	.05
25-303	6	Washer—Nut—Clamp Ring Stud—Crankshaft	Steel	.05
33-79	4	Screw—Cover Assembly to Air Horn	Steel	.025
35-86	1	Cover—Float Bowl and Nozzle	Aluminum	2.90
35-89	1	Gasket—Float Bowl and Nozzle Cover	Fibre	.20
35-94	1	Needle—Idle Adjustment	Brass	.85
35-95	1	Seat—Idle Adjustment	Brass	.80
35-97	1	Float Assembly	Cork	.40
35-99	1	Housing—Strainer	Aluminum	.90
35-101	1	Screw—Strainer Housing	Steel	.30
35-102	1	Gasket—Strainer—Carburetor	Fibre	.10
35-103	1	Gasket—Strainer Screw—Carburetor	Fibre	.05
35-104	1	Plug—Fuel Passage—Carburetor	Brass	.05
35-107	1	Washer—Friction Spring—Carburetor	Steel	.05
35-108	1	Gasket—Fuel Passage Plug—Carburetor	Fibre	.05
35-109	1	Gasket—Air Horn to Carburetor	Fibre	.05
35-112	1	Spring—Air Insert—Carburetor	Brass	.10
35-113	1	Screw—Throttle Adjustment—Carburetor	Steel	.15
35-114	5	Screw—Float Bowl Cover—Carburetor	Steel	.05
35-118	1	Valve and Stem—Float—Carburetor	Steel	.75
37-66	1	Washer—Link to Magneto Plate	Brass	.025
37-154	4	Washer—Float Housing to Receiver	Steel	.025
39-17	7	Lockwasher—Bracket to Operating Cylinder, Filler Plug and Bracket to Cylinder—Side	Steel	.025
39-53	4	Washer—"Y" Valve to Pump Housing	Steel	.025
39-60	1	Lockwasher—Cup Washer—Hand Primer	Steel	.05
39-169	2	Screw—Condenser	Steel	.025
39-176	19	Screw—Seal Ring to Pump Housing, Retainer Disc—Filler Plug, Elbow to Cylinder and Primer Clamp to Brace....	Steel	.05
41-159	2	Screw—Needle Valve and Throttle Handle	Steel	.025
41-316	2	Washer—Muffler to Engine	Steel	.025
43-117	2	Screw—Handle to Valve Stem	Steel	.20
43-121	2	Screw—Spark Plug Cover	Aluminum	.35
43-302	2	Washer—Pressure Regulator and Fuel Valve to Carburetor (Elbow) Manifold	Steel	.025
53-14	1	Nut—Strainer to Bracket	Steel	.10
53-109	1	Lockwasher—Strainer Nut to Bracket	Steel	.025
61-80	2	Screw—Breaker Adjusting	Steel	.025
71-45	6	Screw—Breaker Spring and Terminal Bar—Magneto Plate	Brass	.025
71-46	8	Washer—Rubber Mounting—Gauge Panel	Steel	.025
71-49	6	Washer—Contact—Stop Button, and Breaker Plate	Brass	.025
71-66	14	Washer—Insulating Stop Button and Breaker Plate	Phenolite	.025
71-78	8	Screw—Rubber Mounting—Gage Panel	Brass	.025
71-471	16	Nut—Stop Button to Panel and Contact, Rubber Mounting to Gage Panel and Breaker Spring Screw	Brass	.025
71-610	2	Washer—Breaker Adj. Screw—Magneto Plate	Bronze	.025
71-828	4	Screw—Stop Button to Panel and Contact	Brass	.025

PART NO.	NO. REQ.	DESCRIPTION	MATERIAL	UNIT LIST PRICE
71-914	1	Lockwasher—Handle to Fuel Valve	Steel	.025
71-915	8	Lockwasher—Coil Mounting Screw	Steel	.025
71-918	6	Lockwasher—Stop Button to Panel and Terminal Bar Screw —Breaker Plate	Bronze	.025
71-939	8	Screw—Coil Assembly	Steel	.025
71-1048	2	Washer—Breaker Post—Magneto Plate	Steel	.025
71-1052	2	Clip—Breaker Post—Magneto Plate	Music Wire	.025
71-1128	2	Post—Breaker Arm—Magneto Plate	Steel	.15
71-1148	4	Bushing—Insulating—Contact Stop Button and Insulation—Breaker Plate	Fibre	.025
71-1219	4	Bushing—High Tension Cable	Bakelite	.10
71-1220	4	Clamp—Bushing—High Tension Cable—Magneto Plate	Bakelite	.10
71-1274	2	Nut—Contact and Screw—Magneto Plate	Brass	.05
71-1420	4	Grommet—Ignition Lead—Magneto Plate	Rubber	.05
72-736	2	Arm Assembly—Breaker—Magneto Plate	Spring Steel	.75
72-852	2	Coil Assembly—Less Heels—Magneto Plate	....	5.60
72-855	2	Heel Assembly—Right Hand—Magneto Plate	Steel	.50
72-856	2	Heel Assembly—Left Hand—Magneto Plate	Steel	.50
72-881	1	Button and Spring Assembly—Stop	Steel Comp.	.20
85-64	7	Nut—Throttle Adjustment Screw—Carburetor, and Gage Clip to Panel	Brass	.025
85-101	2	Stud—Elbow to Regulator Valve	Steel	.05
85-105	3	Screw—Panel to Cover	Brass	.05
120001	1	Clamp—Cutout Lead—Magneto Plate	Steel	.025
120011	8	Lockring—Wrist Pin	Steel	.025
120579	1	Lockwasher—Locknut—Crankshaft	Steel	.20
120658	1	Key—Flywheel	Steel	.50
130789	4	Pin—Wrist	Steel	.45
130790	8	Screw—Connecting Rod	Steel	.25
131868	1	Nut—Lock—Crankshaft	Steel	1.80
131888	2	Screw—Center Bearing—Crankshaft	Steel	.20
132804	1	Pin—Dowel—Bearing Race—Center Bearing	Steel	.05
132990	4	Screw—Primer to Carburetor and Magneto Plate Hub	Steel	.025
170191	4	Gasket—Ball Check Valve and Check Valve, Primer—Carburetor and "Y" Valve Screen	Copper Asbestos	.05
170418	2	Gasket—Crankcase to Crankcase Head	Victopac	.05
170753	1	Gasket—Center Bearing Dowel Screw	Copper Asbestos	.05
170755	2	Gasket—Cylinder to Crankcase	Victopac	.05
171102	2	Gasket—Cylinder Head	Corbestos	.20
171109	4	Gasket—Cylinder Head to Elbow	Corbestos	.05
191449	1	Ring and Stud Assembly—Clamp—Ball Bearing Crankshaft	Steel	9.90
192632	3	Bearing—Crankshaft	Steel	4.20
201029	2	Screw—Center Bearing	Steel	.10
201030	1	Screw—Dowel—Center Bearing—Crankshaft	Steel	1.85
201043	1	Nut—Flywheel to Crankshaft	Steel	1.00
201044	2	Gasket—Muffler to Engine	Corbestos	.10
201059	1	Seal—Primer Body—Carburetor	Neoprene	.025
201065	1	Screw—Friction—Magneto Plate	Steel	.25
201066	1	Washer—Magneto Plate Friction Screw	Steel	.025
201076	1	Pin—Friction—Magneto Plate	Steel	.10

PART NO.	NO. REQ.	DESCRIPTION	MATERIAL	UNIT LIST PRICE
201102	18	Nut—Pump Housing to Crankcase Head and Pump Head	Steel	.15
201114	1	Spring—Primer—Carburetor	Steel	.05
201206	1	Clamp—Hose to Magneto Plate	Steel	.15
201375	1	Crankshaft Only	Steel	75.00
201376	24	Retainer—Connecting Rod Bearing	Steel	.65
201377	8	Ring—Piston	Cast Iron	.35
201381	22	Stud—Cylinder Head	Steel	.15
201384	2	Stud—Muffler	Steel	.10
201385	1	Stud—Operating Cylinder Bracket	Steel	.20
201391	4	Stud—Crankcase to Crankcase Head	Steel	.15
201392	2	Stud—Crankcase to (Elbow) Manifold	Steel	.05
201398	1	Spacer—Bearing—Crankshaft	Aluminum	2.35
201399	1	Sleeve—Bearing—Crankshaft	Steel	5.50
201401	2	Nut—Spark Plug Cover	Steel	.70
201402	2	Anchor—High Tension Cable	Brass	.25
201403	2	Support—High Tension Cable	Brass	.45
201421	1	Pointer—Ignition Timing	Steel	.20
201435	4	Retainer—Center Main Bearing Roller	Steel	2.95
201436	1	Fitting—Oil Tube—Intake	Brass	.30
201444	1	Race—Roller Bearing	Steel	8.20
201447	16	Washer—Nut—Cylinder Head Stud	Brass	.025
201448	2	Marker—High Tension Cable Flywheel End	Fabric	.05
201449	2	Marker—High Tension Cable—Pump End	Fabric	.05
201450	1	Hose—Magneto Plate Drain	Neoprene	.25
201465	1	Pin—Magneto Plate	Steel	.65
275274	4	Cable Assembly—High Tension—Magneto Plate	Copper	.30
275741	1	Valve Assembly—Check—Primer—Carburetor	Brass	1.15
275885	2	Stud Assembly—Muffler	Steel	.55
275966	1	Head Assembly—Crankcase	Aluminum and Iron	21.00
275967	4	Piston Assembly with Rings, Wrist Pin and Lock Rings	Aluminum and Steel	9.15
275968	1	Bearing Assembly—Center—Crankshaft	Bronze	63.55
275973	1	Cylinder and Stud Assembly—Right Hand	Iron and Steel	46.75
275974	1	Body and Plug Assembly—Primer—Carburetor	Aluminum	13.75
275975	1	Cylinder and Stud Assembly—Left Hand	Iron and Steel	46.75
275977	1	Crankcase and Stud Assembly	Aluminum and Steel	104.00
275983	4	Rod Assembly—Connecting	Steel	14.00
275987	1	Lead Assembly—Cutout—Magneto Plate	Copper	2.10
276008	2	Head and Cover Assembly—Cylinder—Right Hand	Aluminum	12.00
276009	2	Head and Cover Assembly—Cylinder—Left Hand	Aluminum	12.00
276016	1	Plunger Assembly—Primer—Carburetor	Brass	1.00
276028	2	Plate Assembly—Breaker—Magneto Plate	Steel	.50
276029	1	Plate and Hub Assembly—Magneto	Aluminum and Brass	25.70
276030	1	Tube and Clip Assembly—Carburetor Drain	Copper	2.00
276032	2	Condenser Assembly	....	1.25
300116	2	Gasket—Stop Screw	Fibre	.05
300129	1	Handle—Throttle—Carburetor	Aluminum	.15
300428	2	Screw—Primer to Base	Steel	.05
300449	4	Screw—Muffler to Engine	Steel	.05
300454	2	Grommet—Anchor	Neoprene	.05
300723	2	Pin—Cotter—Gas Tank Hold Down Clamp	Steel	.05

PART NO.	NO. REQ.	DESCRIPTION	MATERIAL	UNIT LIST PRICE
300794	2	Tube—Venturi—Carburetor	Brass	.90
301065	1	Slinger—Water—Crankshaft	Brass	2.20
301067	2	Body—Ball Check Valve	Brass	1.50
301068	2	Seat—Ball Check Valve	Brass	3.90
301069	2	Ball—Check Valve	Rubber	.20
301070	1	Body—Check Valve	Brass	1.00
301071	1	Ring—Seal—Inner—Pump Housing	Gun Metal	9.90
301072	1	Ring—Seal—Outer—Pump Housing	Gun Metal	5.75
301073	1	Impeller	Gun Metal	91.00
301074	1	Nut—Crankshaft to Impeller	Steel	4.10
301076	1	Fitting—Check Valve	Brass	1.20
301077	1	Head—Pump	Aluminum	41.25
301078	1	Disc—Check Valve	Brass	.10
301080	1	Pulley—Starter	Aluminum	15.00
301081	1	Gasket—Check Valve—Pressure Regulator Inlet	Copper Asbestos	.05
301083	1	Bracket—Operating Cylinder	Steel	.40
301084	1	Connector—Operating Cylinder to Link	Brass	.40
301085	1	Link—Operating Cylinder to Armature Base	Brass	1.15
301086	2	Clamp—Gas Tank Hold Down	Brass and Aluminum	1.70
301087	2	Sleeve—Gas Tank Hold Down Clamp	Brass	.06
301088	1	Housing—Spring—Pressure Regulator	Aluminum	6.15
301089	1	Ring—Spacer—Pressure Regulator	Aluminum	6.10
301090	1	Body—Valve—Pressure Regulator	Gun Metal	5.00
301091	14	Pendant—Anchor Chain—Spark Plug Cover and Filler Plug, Pump Head to Thread Protector, "Y" Valve and Receiver	Brass	.02
301092	2	Diaphragm—Pressure Regulator	Fairprene	.10
301093	1	Shaft—Valve—Pressure Regulator	Brass	.20
301094	1	Spacer—Diaphragm—Pressure Regulator	Brass	.25
301095	1	Support—Diaphragm (Upper) Pressure Regulator	Aluminum	.35
301096	1	Spring—Pressure Regulator Valve	Steel	.55
301099	1	Flange—Hose to Receiver	Gun Metal	12.00
301102	2	Valve—"Y" Valve	Aluminum	16.15
301103	2	Cap—"Y" Valve	Aluminum	9.10
301104	2	Sleeve—Valve—"Y" Valve	Bakelite	1.55
301105	2	Ring—Seal—Outlet "Y" Valve	Neoprene	.30
301106	2	Flange—Hose Connector—"Y" Valve	Gun Metal	15.25
301107	2	Handle—"Y" Valve	Aluminum	2.00
301108	2	Stop—Screw—Valve	Steel	1.00
301109	2	Bushing—Lower—Valve Bearing	Bakelite	.30
301110	2	Bushing—Upper—Valve Bearing	Bakelite	.40
301111	2	Nut—Packing—Valve Stem	Steel	7.10
301112	1	Extension—Water Inlet—Pressure Connection	Brass	.60
301113	1	Handle—Screw—Filler Plug	Aluminum and Brass	2.55
301114	1	Support—Screw—Filler Plug	Aluminum	1.25
301115	2	Disc—Retainer—Filler Plug	Brass	.85
301116	1	Filter—Fuel	....	17.00
301117	1	Handle—Pressure Regulator	Brass and Aluminum	1.60
301119	4	Mounting—Rubber—Gauge Panel	Brass and Rubber	1.90
301120	1	Panel—Gauge	Brass	1.50
301121	1	Cap—Thread Protector—Exhaust	Aluminum	6.95

PART NO.	NO. REQ.	DESCRIPTION	MATERIAL	UNIT LIST PRICE
301122	3	Cap—Thread Protector—Hose Connection	Aluminum	5.65
301123	2	Stuffing—Hand Primer	Felt	.01
301125	2	Tank—Fuel	Steel	47.00
301126	1	Gauge—Pressure	Brass	16.15
301127	1	Gauge—Temperature	Brass	39.25
301128	1	Gland—Stuffing—Hand Primer	Brass	.40
301129	1	Valve—Fuel	Brass	6.00
301133	1	Horn—Air—Carburetor Intake	Aluminum	3.50
301134	4	Elbow—Muffler to Cylinder Head	Aluminum	2.00
301136	1	Gasket—Float Housing to Receiver	Service Sheet	.10
301140	1	Pin—Connector to Link	Brass	.10
301141	2	Pin—Ball Check Valve	Brass	.01
301145	1	Key—Crankshaft to Impeller	Steel	.65
301147	1	Gasket—Receiver to Muffler	Service Sheet	.15
301148	2	Spring—Gas Tank Hold Down Clamp	Steel	.20
301150	1	Gasket—Pump Head to Pump Housing	Service Sheet	.35
301151	4	Screw—Flange to Receiver	Steel	.15
301153	2	Packing—Valve Stem	Garlock Packing	.10
301154	4	Spacer—Gauge Panel to Rubber Mounting	Brass	.05
301156	5	Plug—Hinge Pin Hole—Foot Valve, Primer and Drain Hole	Brass	.15
301158	1	Plug—Water Passage to Seals	Brass	.10
301159	2	Seal—Pump Housing—and Crankcase Head	Steel and Comp.	14.85
301161	21	Washer—Pump Housing to Crankcase Head, Pump Head and Receiver to Muffler	Steel	.05
301163	2	Gasket—Hose Flange to Body—"Y" Valve	Service Sheet	.05
301164	2	Gasket—Cap to Body—"Y" Valve	Service Sheet	.15
301165	2	Bushing—Handle to Valve Stem	Steel	.15
301168	2	Spacer—Stop Button and Spring to Panel	Bakelite	.15
301169	4	Clip—Gauge to Panel	Steel	.30
301172	4	Gasket—Muffler to Elbow	Service Sheet	.05
301173	1	Gasket—Carburetor (Elbow) Manifold to Crankcase	Service Sheet	.05
301175	1	Gasket—"Y" Valve to Pump Housing	Service Sheet	.20
301179	4	Plug—Pipe—Muffler Bottom	Brass	.40
301180	14	Stud—Pump Housing to Head	Steel	.30
301181	4	Stud—Pump Housing to "Y" Valve	Steel	.35
301182	4	Screw—Gauge Panel to Rubber Mounting	Brass	.20
301184	8	Screw—Hose Flange to Body	Steel	.30
301185	12	Stud—Cap to Body—"Y" Valve	Steel	.25
301195	2	Screw—Frame Bracket to Pump Housing	Steel	.35
301200	3	Screw—Cap—Starter Pulley to Flywheel	Steel	.30
301201	1	Support—Diaphragm—Lower	Brass	.20
301217	2	Stud—Muffler to Receiver	Steel	.25
301218	2	Screw—Frame Bracket to Muffler	Steel	.35
301219	6	Screw—Housing to Body	Steel	.90
301249	1	Housing—Float—Receiver	Brass	8.60
301250	12	Washer—Cap to Body—"Y" Valve	Steel	.05
301252	1	Lockring—Plug—Panel Assembly	Steel	.10
301253	1	Plug—Cutout—Panel	Brass and Bakelite	.30
301256	4	Screw—Drive—Name Plate to Muffler	Steel	.01
301257	1	Gasket—Hose Flange to Receiver	Service Sheet	.10

PART NO.	NO. REQ.	DESCRIPTION	MATERIAL	UNIT LIST PRICE
301258	1	Housing—Foot Valve	Brass	75.00
301259	1	Retainer—Screen—Outer—Foot Valve	Brass	60.00
301260	1	Retainer—Screen—Inner—Foot Valve	Brass	67.50
301261	1	Arm—Valve Hinge—Foot Valve	Brass	10.50
301262	1	Pin—Hinge—Foot Valve	Brass	.60
301263	1	Pin—Valve and Arm Pivot—Foot Valve	Brass	1.15
301264	1	Spring—Valve—Foot Valve	Brass	.80
301265	1	Screen—Foot Valve	Brass	10.75
301266	3	Screw—Screen Retainer—Foot Valve	Brass	.70
301267	1	Gasket—Housing to Valve Seat	Service Sheet	.60
301300	2	Spacer—Fuel Valve to Elbow	Brass	.10
301301	1	Elbow—Pressure Regulator Inlet	Brass	.20
301308	1	Washer—Upper—Hand Primer	Brass	.70
301309	1	Washer—Lower—Hand Primer	Brass	.80
301310	1	Washer—Cup—Hand Primer	Rubber	.95
301311	2	Nut—Cup Washer—Hand Primer	Brass	.15
301313	1	Ball—Check Valve—Hand Primer	Rubber	.25
301314	1	Plug—Check Valve—Hand Primer	Brass	.50
301315	1	Gasket—Check Valve—Hand Primer	Copper and Asbestos	.05
301316	1	Elbow—Suction Inlet—Hand Primer	....	.40
301317	1	Spring—Hand Primer	Bronze	.15
301320	1	Fitting—Suction Pipe to Pump Head	Brass	.75
301321	1	Tee—Pressure Regulator Gauge	Brass	.20
301322	2	Elbow—Ball Check Valve—Water Seal	Brass	.15
301323	2	Stud—Elbow to Fuel Valve	Steel	.10
301324	1	Seat—Valve—Foot Valve	Brass	35.10
301325	6	Screw—Valve Seat to Housing—Foot Valve	Brass	.70
301326	5	Screw—Housing to Screen Retainer—Foot Valve	Brass	.70
301327	1	Washer—Housing to Hose Connection—Foot Valve	Neoprene	.35
301346	4	Spark Plug (Champion R-1)	....	*.90
301347	4	Chain—Anchor—Cap Thread Protector and Pump Head to Thread Protector	Brass	.05
301348	3	Chain—Anchor—Spark Plug Cover and Filler Plug	Brass	.025
301356	1	Fitting—Adapter—Tube to Gauge	Brass	.60
301358	2	Screw—Screen and Air Horn to Carburetor	Steel	.15
301360	4	Elbow—Cooling Water—Outlet from Engine and Pump Housing	Brass	.40
301362	2	Screw—Carburetor to (Elbow) Manifold	Steel	.05
301382	1	Tube—Drain—Carburetor	Neoprene	.45
301388	1	Washer—Center—Hand Primer	Brass	.05
301393	2	Gasket—Carburetor to Primer and Carburetor to Elbow	Velumoid	.02
301395	1	Carburetor Body	Aluminum and Brass	7.75
301396	1	Shaft Assembly—Throttle—Carburetor	Aluminum and Brass	2.50
301397	1	Fitting—Cooling Water—Inlet to Muffler and Fuel Intake—Carburetor	Brass	.30
301398	1	Plate—Throttle—Carburetor	Steel	.25
301399	1	Valve—Needle—High Speed—Carburetor	Brass	1.75
301400	1	Collar—Friction—Carburetor	Aluminum	1.20
301401	1	Insert—Air—Carburetor	Aluminum	1.65
301402	1	Link—Bent Swivel—Carburetor	Steel	1.50

PART NO.	NO. REQ.	DESCRIPTION	MATERIAL	UNIT LIST PRICE
301403	2	Lever—Friction—Carburetor	Brass	.50
301404	2	Disc—Friction—Carburetor	Bakelite	.10
301405	1	Washer—Thrust—Carburetor	Steel	.10
301406	1	Element—Filter—Strainer	Brass	7.50
301407	1	Gasket—Strainer Bowl	Neoprene and Cork	.35
301408	1	Bowl—Strainer	Brass	3.00
301409	1	Handle—Fuel Valve	Brass	.75
301410	1	Spring—Friction—Carburetor	Steel	.20
301411	2	Screw—Throttle—Carburetor	....	.05
301413	48	Rollers—Connecting Rod	Steel	.10
301414	1	Plate—Name—Blank—Specification	Brass	.30
301416	1	Handle—Needle Valve—Carburetor	Aluminum	.45
375399	1	Primer Assembly—Carburetor	Aluminum and Brass	19.35
375400	1	Magneto Plate Assembly	....	66.00
375401	1	Carburetor Complete	Steel, Alum. and Brass	49.50
375402	1	Hand Primer Assembly	Brass and Aluminum	46.00
375403	1	Frame Assembly	Steel	74.45
375404	1	Cylinder Assembly—Operating	Brass	38.50
375405	1	Muffler Assembly	Aluminum and Steel	126.00
375407	1	Valve—Check—Pressure Regulator Inlet	....	2.55
375408	1	Manifold (Elbow) Assembly—Carburetor to Crankcase	Aluminum	16.70
375409	1	Regulator—Pressure—Valve Assembly	Aluminum and Brass	27.85
375411	1	"Y" Valve Assembly	Alum., Steel and Brass	206.30
375412	1	Plug Assembly—Filler	Aluminum and Brass	10.00
375415	2	Cover Assembly—Spark Plug	Aluminum	6.30
375416	1	Foot Valve Assembly	Brass	225.00
375417	2	Elbow and Check Valve Assembly for Muffler and Crankcase Drain	Brass	.60
375418	2	Gas Line Assembly—Fuel Tank to Fuel Valve	Brass and Rubber	9.35
375421	2	Elbow and Screen Assembly—Crankcase Drain	Brass	.50
375424	1	Panel and Support Assembly	....	6.35
375427	1	Plug and Gasket Assembly	Alum. and Neoprene	2.65
375431	1	Float Assembly—Receiver	Brass	2.85
375433	1	Disc Assembly—Foot Valve	Neoprene and Brass	13.30
375436	1	Cap and Shield Assembly—Hand Primer	Brass	7.95
375438	1	Screen Assembly—Water Supply to Pressure Regulator	Brass	1.00
375439	1	Cover Assembly—Carburetor Air Horn	Brass	5.95
375440	1	Base and Barrel Assembly—Hand Primer	Brass	27.50
375442	1	Screen Assembly—Carburetor Intake	Brass	1.90
375451	1	Flywheel Assembly	Aluminum and Steel	41.55
375457	1	Lead Assembly—Stop Switch to Plug	....	.50
375459	1	Tube Assembly—Crankcase to Crankcase Head	Copper and Brass	.55
375460	1	Tube Assembly—Crankcase to Muffler	Copper and Brass	.50
375461	1	Tube Assembly—Pump Housing	Copper and Brass	1.90
375462	1	Tube Assembly—Pump Housing to Cylinder—Left	Copper and Brass	1.90
375463	1	Tube Assembly—Pump Housing to Muffler	Copper and Brass	.65
375464	1	Tube Assembly—Pump Head to Primer	Copper and Brass	1.25
375465	1	Tube Assembly—Pressure Regulator to Operating Cylinder	Copper and Brass	.50
375466	1	Tube Assembly—"Y" Valve to Tee	Copper and Brass	1.30
375467	1	Tube Assembly—Overflow from Pressure Regulator	Copper and Brass	.75

PART NO.	NO. REQ.	DESCRIPTION	MATERIAL	UNIT LIST PRICE
375468	1	Tube Assembly—"Y" Valve to Pressure Regulator	Copper and Brass	.55
375469	1	Tube Assembly—Pressure Regulator to Tee	Copper and Brass	1.20
375470	1	Tube Assembly—Gas Line—Valve to Strainer	Copper and Brass	.65
375471	1	Tube Assembly—Gas Line Strainer to Carburetor	Copper and Brass	.65
375472	1	Tube Assembly—Ball Check Valve to Muffler	Copper and Brass	.60
375473	1	Tube Assembly—Ball Check Valve to Receiver	....	.55
375474	1	Handle and Rod Assembly—Hand Primer	Brass and Aluminum	4.05
375475	1	Valve Assembly—Ball Check—Pump Housing	....	6.10
375480	3	Clamp—Hose to Terminal Ring and Carburetor Drain	Brass	.30
375481	1	Housing Assembly—Pump	Alum., Brass and Steel	115.50
375482	1	Body Assembly—Receiver	Alum., Brass and Steel	32.75
375483	1	Body Assembly—"Y" Valve	Alum., Brass and Steel	59.00
375484	1	Pilot—Pressure Regulator Spring	Brass	.60
375485	1	Crankshaft Assembly	Steel and Brass	90.50

Note—Above List Prices Do Not Include Processing for Overseas Shipment.

NOTES

JOHNSON MODEL P-500 PUMP ASSEMBLY BREAKDOWN LIST

ASSEMBLY NUMBER	DETAIL NUMBER	QUANTITY PER UNIT	QUANTITY PER ASSEMBLY	DESCRIPTION
*35-94	......	1	......	Float Assembly—Carburetor
*72-736	......	2	......	Arm Assembly—Breaker—Magneto Plate
*72-852	......	2	......	Coils Assembly—Less Heels—Magneto Plate
*72-855	......	2	......	Heel Assembly—Coil (Right Hand) Magneto Plate
*72-856	......	2	......	Heel Assembly—Coil (Left Hand) Magneto Plate
*72-881	......	1	......	Stop Button and Spring Assembly—Magneto Plate
*191449	......	1	......	Clamp Ring and Stud Assembly—Ball Bearing—Crankshaft
*275274	......	4	......	Cable Assembly—High Tension—Magneto Plate
*275741	......	1	......	Valve Assembly—Check—Primer—Carburetor
*275885	......	2	......	Stud Assembly—Muffler
*275966	......	1	......	Head Assembly—Crankcase
275967	......	4	......	Piston Assembly with Rings and Wrist Pin
......	120011	......	2	Ring—Lock
......	130789	......	1	Pin—Wrist
......	201377	......	2	Ring—Piston
......	**	......	1	Piston
275968	......	1	......	Bearing Assembly—Center—Crankshaft
......	13-51	......	2	Lockwasher
......	131888	......	2	Screw
......	**	......	1	Bearing—Center—Rear
......	**	......	1	Bearing—Center—Front
......	**	......	2	Pin—Dowel
275973	......	1	......	Cylinder and Stud Assembly—Right Hand
......	201381	......	11	Stud—Cylinder Head
......	201384	......	1	Stud—Muffler
......	301360	......	1	Elbow—Water Pipe
......	**	......	1	Cylinder
*275974	......	1	......	Body and Plug Assembly—Primer—Carburetor
275975	......	1	......	Cylinder and Stud Assembly—Left Hand
......	201381	......	11	Stud—Cylinder Head
......	201384	......	1	Stud—Muffler
......	201385	......	1	Stud—Operating Cylinder Bracket
......	301360	......	1	Elbow—Water Pipe
......	**	......	1	Cylinder
275977	......	1	......	Crankcase and Stud Assembly
......	21-98	......	12	Stud—Crankcase to Cylinder
......	201391	......	4	Stud—Crankcase to Crankcase Head

** Not Serviced but Included in Assembly
* Sold as an Assembly Only

ASSEMBLY NUMBER	DETAIL NUMBER	QUANTITY PER UNIT	QUANTITY PER ASSEMBLY	DESCRIPTION
......	201392	......	2	Stud—Crankcase to Elbow
......	201436	......	1	Fitting—Oil Tube—Intake
......	**	......	6	Screw—Adjusting—Crankshaft Ball Bearing
......	**	......	1	Pin—Locking—Magneto Plate
......	**	......	1	Crankcase and Bushing
275983	......	4	.....	Rod Assembly—Connecting
......	130790	......	2	Screw
......	*	......	1	Rod—Connecting
......	*	......	1	Bushing—Wrist Pin
*275987	......	1	......	Lead Assembly—Cutout
*276008	......	2	......	Head and Cover Assembly—Cylinder—Right Hand
*276009	......	2	......	Head and Cover Assembly—Cylinder—Left Hand
*276016	......	1	......	Plunger Assembly—Primer—Carburetor
*276028	......	2	......	Plate Assembly—Breaker—Magneto Plate
276029	......	1	......	Plate and Hub Assembly—Magneto
......	132990	......	2	Screw—Hub
......	201065	......	1	Screw—Friction
......	201066	......	1	Spring Washer—Friction Screw
......	201076	......	1	Pin—Friction
......	201400	......	1	Pin
......	**	......	1	Plate
......	**	......	1	Hub
......	**	......	1	Oil Tube Terminal Assembly
*276030	......	1	......	Tube and Clip Assembly—Carburetor Drain
*276032	......	2	......	Condenser Assembly
301116	......	1	......	Fuel Filter
......	301406	......	1	Disc Assembly—Strainer
......	301407	......	1	Gasket—Strain Bowl
......	301408	......	1	Bowl—Strainer
......	**	......	1	Cover and Bail Assembly—Strainer
*301396	......	1	......	Shaft Assembly—Throttle—Carburetor
*301406	......	1	......	Disc Assembly—Strainer
375399	......	1	......	Primer Assembly—Carburetor
......	170191	......	1	Gasket—Check Valve
......	201059	......	1	Seal—Primer Body
......	201114	......	1	Spring—Primer
......	275741	......	1	Valve Assembly—Check
......	275974	......	1	Body and Plug Assembly
......	276016	......	1	Plunger Assembly
375400	......	1	......	Magneto Plate Assembly

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ASSEMBLY NUMBER	DETAIL NUMBER	QUANTITY PER UNIT	QUANTITY PER ASSEMBLY	DESCRIPTION
......	3-27	......	4	Lockwasher—High Tension Cable Clamp
......	3-28	......	3	Lockwasher—Condenser and Cutout Lead Screw
......	5-114	......	8	Screw—High Tension Cable Clamp
......	13-100	......	1	Screw—Cutout Lead Clamp
......	39-169	......	2	Screw—Condenser Mounting
......	61-80	......	2	Screw—Breaker—Adjusting
......	71-45	......	6	Screw—Breaker Spring and Terminal Bar
......	71-471	......	2	Nut—Breaker Spring Screw
......	71-610	......	2	Washer—Breaker Adjusting Screw
......	71-915	......	8	Lockwasher—Screw—Coil Mounting
......	71-918	......	4	Lockwasher—Terminal Bar Screw—Breaker
......	71-939	......	8	Screw—Coil Assembly
......	71-1048	......	2	Washer—Breaker Post
......	71-1052	......	2	Clip—Breaker Post
......	71-1128	......	2	Post—Breaker
......	71-1148	......	2	Bushing—Breaker Plate
......	71-1219	......	4	Bushing—High Tension Cable
......	71-1220	......	4	Bushing—Clamp—High Tension Cable
......	71-1274	......	2	Nut—Contact Point
......	72-736	......	2	Arm Assembly—Breaker
......	72-852	......	2	Coil Assembly
......	72-855	......	2	Heel Assembly—Right Hand
......	72-856	......	2	Heel Assembly—Left Hand
......	120001	......	1	Clamp—Cutout Lead
......	201206	......	1	Clamp—Hose to Magneto Plate
......	201448	......	2	Marker—High Tension Cable—Flywheel End
......	201449	......	2	Marker—High Tension Cable—Pump End
......	201450	......	1	Hose—Magneto Plate Drain
......	275274	......	4	Cable—High Tension
......	275987	......	1	Lead—Cutout
......	276028	......	2	Plate—Breaker
......	276029	......	1	Plate and Hub Assembly
......	276032	......	2	Condenser Assembly
375401	......	1	......	Carburetor Assembly
......	1-132	......	1	Screw
......	5-136	......	5	Lockwasher—Cover Screw
......	17-186	......	2	Pin—Cotter
......	23-194	......	2	Gasket—Fuel Passage Screw
......	23-232	......	2	Screw—Fuel Passage
......	35-86	......	1	Cover—Float Bowl and Nozzle
......	35-89	......	1	Gasket—Float Bowl and Nozzle Cover
......	35-94	......	1	Needle—Idle Adjustment
......	35-95	......	1	Seat—Idle Adjustment
......	35-97	......	1	Float
......	35-99	......	1	Housing—Strainer
......	35-101	......	1	Screw—Strainer Housing
......	35-102	......	1	Gasket—Strainer

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ASSEMBLY NUMBER	DETAIL NUMBER	QUANTITY PER UNIT	QUANTITY PER ASSEMBLY	DESCRIPTION
......	35-103	......	1	Gasket—Strainer Screw
......	35-104	......	1	Plug—Fuel Passage
......	35-107	......	1	Washer—Friction Spring
......	35-108	......	1	Gasket—Fuel Passage Plug
......	35-109	......	1	Gasket—Air Horn
......	35-112	......	1	Spring—Air Insert
......	35-113	......	1	Screw—Throttle Adjustment
......	35-114	......	5	Screw—Float Bowl Cover
......	35-118	......	1	Valve and Stem—Float
......	85-64	......	3	Nut—Throttle Adjustment Screw
......	300794	......	2	Tube—Venturi
......	301395	......	1	Body—Carburetor
......	301396	......	1	Shaft—Throttle
......	301397	......	1	Fitting—Fuel Intake
......	301398	......	1	Plate—Throttle
......	301399	......	1	Valve—High Speed Needle
......	301400	......	1	Collar—Friction
......	301401	......	1	Insert—Air
......	301402	......	1	Link—Bent Swivel
......	301403	......	2	Lever—Friction
......	301404	......	2	Disc—Friction
......	301405	......	1	Washer—Thrust
......	301410	......	1	Spring—Friction
......	301411	......	2	Screw—Throttle
375402	......	1	......	Hand Primer Assembly
......	39-60	......	1	Lockwasher—Cup Washer
......	301123	......	2	Stuffing—Hand Primer
......	301128	......	1	Gland—Stuffing—Hand Primer
......	301156	......	2	Plug—Pipe
......	301308	......	1	Washer—Upper
......	301309	......	1	Washer—Lower
......	301310	......	1	Washer—Cup
......	301311	......	2	Nut—Cup Washer
......	301313	......	1	Ball—Check Valve
......	301314	......	1	Plug—Check Valve
......	301315	......	1	Gasket—Hand Primer
......	301316	......	1	Elbow—Suction Inlet
......	301317	......	1	Spring—Stop
......	301388	......	1	Washer—Center—Hand Primer
......	375436	......	1	Cap and Shield Assembly
......	375440	......	1	Base and Barrel Assembly
......	375474	......	1	Handle and Rod Assembly
*375403	......	1	......	Frame Assembly
*375404	......	1	......	Cylinder Assembly—Operating
375405	......	1	......	Muffler Assembly

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ASSEMBLY NUMBER	DETAIL NUMBER	QUANTITY PER UNIT	QUANTITY PER ASSEMBLY	DESCRIPTION
......	17-138	......	1	Elbow—Water Inlet—Cooling
......	301156	......	1	Plug—Drain Hole
......	301217	......	2	Stud—Muffler to Receiver
......	301322	......	1	Elbow—Tube from Water Seal
......	375417	......	1	Elbow and Check Valve Assembly—Drain
......	375441	......	1	Muffler and Plug Assembly
375407	......	1	......	Check Valve Assembly—Pressure Regulator Inlet
......	301070	......	1	Body—Check Valve
......	301076	......	1	Fitting—Check Valve
......	301078	......	1	Disc—Check Valve
......	301081	......	1	Gasket—Check Valve
375408	......	1	......	Manifold (Elbow) Assembly—Carburetor to Crankcase
......	85-101	......	2	Stud—Elbow to Regulator Valve
......	301323	......	2	Stud—Elbow to 3 Way Valve
......	**	......	1	Elbow—Carburetor Intake Passage
375409	......	1	......	Regulator—Pressure—Valve Assembly
......	13-330	......	2	Nut—Valve Shaft
......	13-370	......	2	Fitting—Tube to Pressure Regulator
......	17-138	......	1	Elbow—Pressure Regulator Drain
......	301088	......	1	Housing—Spring
......	301089	......	1	Ring—Spacer
......	301090	......	1	Body—Valve
......	301092	......	2	Diaphragm
......	301093	......	1	Shaft—Valve
......	301094	......	1	Spacer—Diaphragm
......	301095	......	1	Support—Diaphragm Upper
......	301096	......	1	Spring
......	301097	......	1	Pilot—Spring
......	301201	......	1	Support—Diaphragm
......	301219	......	6	Screw—Housing to Body
......	301301	......	1	Elbow—Inlet
375411	......	1	......	"Y" Valve Assembly
......	11-216	......	2	Nut—Handle to Valve Stem
......	13-371	......	2	Elbow—Y-valve to Screen
......	21-475	......	12	Nut—Cap to Body
......	43-117	......	2	Screw—Handle to Valve Stem
......	170191	......	1	Gasket—Screen Assembly
......	301091	......	4	Pendant—Anchor Chain
......	**	......	1	Body
......	301102	......	2	Valve
......	301103	......	2	Cap
......	301104	......	2	Sleeve
......	301105	......	2	Ring—Seal—Outlet
......	301106	......	2	Flange—Hose—Connector

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ASSEMBLY NUMBER	DETAIL NUMBER	QUANTITY PER UNIT	QUANTITY PER ASSEMBLY	DESCRIPTION
......	301107	......	2	Handle
......	301108	......	2	Stop—Screw
......	301109	......	2	Bushing—Lower—Valve Bearing
......	301110	......	2	Bushing—Upper—Valve Bearing
......	301111	......	2	Nut—Packing—Valve Stem
......	301112	......	1	Extension—Water Inlet—Pressure Connection
......	301116	......	2	Gasket—Stop Screw—Valve
......	301122	......	2	Cap—Thread Protector
......	301153	......	2	Packing—Valve Stem
......	301163	......	2	Gasket—Hose Flange to Body
......	301164	......	2	Gasket—Cap to Body
......	301165	......	2	Bushing—Handle to Valve Stem
......	301181	......	2	Stud—"Y" Valve to Pump Housing
......	301184	......	8	Screw—Hose Flange to Body
......	301185	......	12	Stud—Cap to Body
......	301250	......	12	Washer—Cap to Body
......	301347	......	2	Chain—Anchor—Thread Protector
......	375438	......	1	Screen Assembly—Water Suppy to Pressure Regulator
375412	......	1	......	Plug Assembly—Filler—Pump Casing
......	39-17	......	2	Washer
......	39-176	......	2	Screw—Retainer Disc
......	301091	......	1	Pendant—Anchor Chain
......	301113	......	1	Handle—Screw
......	301114	......	1	Support—Screw
......	301115	......	2	Disc—Retainer
......	301348	......	1	Chain—Anchor
......	375427	......	1	Plug and Gasket Assembly
375415	......	2	......	Cover Assembly—Spark Plug
......	15-268	......	1	Pin—Cotter—Spark Plug Cover Screw
......	43-121	......	1	Screw
......	301091	......	1	Pendant—Anchor Chain
......	301348	......	1	Chain—Anchor
......	**	......	1	Cover
......	**	......	2	Spring—Cutout Button
......	**	......	2	Button—Cutout Button
......	**	......	4	Rivet—Spring to Cover
375416	......	1	......	Foot Valve Assembly
......	13-332	......	2	Pin—Cotter—Valve and Arm Pivot Pin
......	301156	......	2	Plug—Hinge Pin Hole
......	301258	......	1	Housing—Valve
......	301259	......	1	Retainer—Screen—Outer
......	301260	......	1	Retainer—Screen—Inner
......	301261	......	1	Arm—Valve Hinge
......	301262	......	1	Pin—Hinge
......	301263	......	1	Pin—Valve and Arm Pivot

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ASSEMBLY NUMBER	DETAIL NUMBER	QUANTITY PER UNIT	QUANTITY PER ASSEMBLY	DESCRIPTION
......	301264	......	1	Spring—Valve
......	301265	......	1	Screen
......	301266	......	3	Screw—Screen Retainer
......	301267	......	1	Gasket—Housing to Valve Seat
......	301324	......	1	Seat—Valve
......	301325	......	6	Screw—Valve Seat to Housing
......	301326	......	5	Screw—Housing to Screen Retainer
......	301327	......	1	Washer—Housing to Hose Connection
......	375433	......	1	Disc Assembly—Valve
*375417	......	2	......	Elbow and Check Valve Assembly for Muffler and Crankcase Drain
*375418	......	2	......	Gas Line Assembly—Gas Tank to 3-Way Valve
*375421	......	2	......	Elbow and Screen Assembly—Crankcase Drain
*375424	......	1	......	Panel and Support Assembly
*375427	......	1	......	Plug and Gasket Assembly
*375431	......	1	......	Float Assembly—Receiver
*375433	......	1	......	Disc Assembly—Foot Valve
*375436	......	1	......	Cap and Shield—Hand Primer
*375438	......	1	......	Screen Assembly—Water Supply to Pressure Regulator
*375439	......	1	......	Cover Assembly
*375440	......	1	......	Base and Barrel Assembly—Hand Primer
*375442	......	1	......	Screen Assembly—Carburetor Intake
*375451	......	1	......	Flywheel Assembly
*375457	......	1	......	Lead Assembly—Stop Switch to Plug
*375459	......	1	......	Tube Assembly—Crankcase to Crankcase Head
*375460	......	1	......	Tube Assembly—Crankcase to Muffler
*375461	......	1	......	Tube Assembly—Pump Housing to Cylinder—Right
*375462	......	1	......	Tube Assembly—Pump to Cylinder
*375463	......	1	......	Tube Assembly—Pump Housing to Muffler
*375464	......	1	......	Tube Assembly—Pump Head to Primer
*375465	......	1	......	Tube Assembly—Pressure Regulator to Operating Cylinder
*375466	......	1	......	Tube Assembly—"Y" Valve to Tee
*375467	......	1	......	Tube Assembly—Overflow from Pressure Regulator
*375468	......	1	......	Tube Assembly—"Y" Valve to Pressure Regulator
*375469	......	1	......	Tube Assembly—Pressure Regulator to Tee
*375470	......	1	......	Tube Assembly—Gas Line—Valve to Strainer
*375471	......	1	......	Tube Assembly—Gas Line—Strainer to Carburetor
*375472	......	1	......	Tube Assembly—Ball Check Valve to Muffler
*375473	......	1	......	Tube Assembly—Ball Check Valve to Receiver
*375474	......	1	......	Handle and Rod Assembly—Hand Primer
375475	......	1	......	Valve Assembly—Ball Check—Pump Housing
......	170191	......	1	Gasket
......	301067	......	1	Body
......	301068	......	1	Seat
......	301069	......	1	Ball
......	301141	......	1	Pin

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ASSEMBLY NUMBER	DETAIL NUMBER	QUANTITY PER UNIT	QUANTITY PER ASSEMBLY	DESCRIPTION
*375480	......	3	......	Clamp Assembly—Hose—Carburetor Drain
375481	......	1	......	Housing Assembly—Pump
......	39-176	......	7	Screw—Seal Ring to Pump Housing
......	301071	......	1	Ring—Seal—Inner
......	301072	......	1	Ring—Seal—Outer
......	301150	......	1	Gasket—Pump Housing to Pump Head
......	301158	......	1	Plug—Water Passage to Seals
......	301159	......	1	Seal—Carbon Type—Pump Housing
......	301180	......	14	Stud—Pump Housing to Pump Head
......	301181	......	2	Stud—Pump Housing to "Y" Valve
......	301360	......	2	Elbow—Cooling Water—Outlet from Engine
......	301397	......	1	Fitting—Cooling Water—Inlet to Muffler
......	**	......	1	Housing—Pump
375482	......	1	......	Body Assembly—Receiver
......	17-138	......	1	Elbow—Receiver to Pressure Regulator
......	21-189	......	1	Stud—Receiver to Muffler
......	23-215	......	1	Elbow—Water Connection to Receiver
......	301098	......	1	Receiver
375483	......	1	......	Body Assembly—"Y" Valve
......	13-371	......	2	Elbow—"Y" Valve to Tee and Screen Assembly
......	170191	......	1	Gasket—Screen Assembly
......	300116	......	1	Gasket—Stop Screw—Valve
......	301108	......	1	Screw—Stop
......	301109	......	1	Bushing—Lower
......	301112	......	1	Extension—Water Inlet
......	301181	......	2	Stud—"Y" Valve to Pump Housing
......	301185	......	12	Stud—Cap to Body
......	375438	......	1	Screen Assembly
......	**	......	1	Body—"Y" Valve
*375484	......	1	......	Pilot Pressure Regulator Spring
375485	......	1	......	Crankshaft Assembly
......	21-13	......	14	Roller—Center Bearing
......	120579	......	1	Lockwasher—Crankshaft Locknut
......	131868	......	1	Nut
......	132804	......	1	Pin—Dowel—Bearing Race—Center Bearing
......	191449	......	1	Clamp Ring and Stud Assembly
......	192632	......	3	Bearing
......	201375	......	1	Crankshaft
......	201398	......	1	Spacer—Ball Bearing
......	201399	......	1	Sleeve—Ball Bearing
......	201435	......	4	Retainer—Roller—Center Bearing
......	201444	......	1	Race—Roller—Center Bearing
......	275968	......	1	Center Bearing Assembly

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OPERATING MATERIAL

The following is packed with each Model P-500 pump unit (furnished by pump manufacturer):

IN CANVAS BAG

QUAN.	PART NUMBER	DESCRIPTION
2	72-736	Arm Assembly—Breaker
2	276032	Condenser Assembly
2	276028	Breaker Plate Assembly
24	301.346	Spark Plugs—in carton
1	301351	Bag—Canvas
5	301420	Manual—Operating Instructions
		IN ENVELOPE (inside packing box)
1	301421	Instruction Book

SPARE PARTS, TOOLS AND WRENCHES

The following, packed in metal box No. 301359, is supplied by the pump manufacturer but packed and shipped in separate shipping box as directed by Navy. One set should be available for at least each two pump units.

QUAN.	PART NUMBER	DESCRIPTION
2	5-57	Nut—Y-Valve to Pump Housing
8	5-114	Screw—High tension cable bushing clamp
3	7-45	Nut
2	7-46	Nut—Elbow—Carburetor to Crankcase
4	7-235	Washer—Elbow to muffler and Carburetor elbow to crankcase
1	11-216	Nut—Handle to Valve Stem
2	13-330	Nut—Operating Cylinder to Bracket
2	13-481	Washer—Lock—Frame to Pump
2	13-588	Screw—Elbow to Muffler
6	16-19	Starting Rope
1	19-136	Nut—Regulator Valve to Carburetor Elbow
1	21-180	Washer—Gas Tank Hold Down
8	21-359	Screw—Cylinder Head Core Hole Cover
8	21-475	Nut—Muffler to Power Head
2	33-79	Screw—Panel to Air Horn
1	35-109	Gasket—Air Horn to Carburetor
4	37-154	Washer—Bracket to Cylinder Side and Muffler to Power Head
1	39-17	Washer—Filler Plug
2	39-53	Washer—Y-Valve to Pump Housing
1	39-60	Lockwasher—Cup Washer
2	39-169	Screw—Condenser

QUAN.	PART NUMBER	DESCRIPTION
10	39-176	Screw—Seal Ring to Housing and Retainer Disc to Filler Plug
1	41-159	Screw—Needle and Throttle Valve
2	41-316	Washer—Muffler to Power Head
1	43-117	Screw—Handle to Valve Stem
1	43-121	Screw—Spark Plug Cover
2	43-302	Washer—Regulator to Carburetor Elbow
1	53-109	Washer—Strainer Nut to Bracket
2	61-80	Screw—Breaker Adjusting
2	71-45	Screw—Breaker Spring
4	71-46	Washer—Rubber Mounting—Gage
4	71-49	Washer—Contact—Stop Button
4	71-66	Washer—Insulating—Stop Button
4	71-78	Screw—Rubber Mounting—Gage Panel
7	71-471	Nut—Stop Button and Rubber Mounting to Panel
2	71-828	Screw—Stop Button to Panel
2	71-918	Lockwasher—Stop Button to Panel
4	71-939	Screw—Coil Assembly
1	72-852	Coil Assembly—Ignition
2	85-64	Nut—Gage Clip to Panel
1	130255	Screw—Cut-out Lead Clamp
3	132990	Screw—Armature Base Hub and Primer to Carburetor
1	170191	Gasket—Ball Check Valve
1	170418	Gasket—Crankcase—$\frac{1}{64}$
2	170755	Gasket—Cylinder
2	171102	Gasket—Cylinder Head
4	171109	Gasket—Inlet Water Manifold
1	201043	Nut—Flywheel
2	201044	Gasket—Muffler to Power Head
1	201065	Screw—Friction—Armature Base
9	201102	Nut—Pump Housing to Crankcase Head and Hose Flange
1	201236	Feeler—Breaker and Spark Plug
2	276008	Cylinder Head and Cover Assembly—R. H.
2	276009	Cylinder Head and Cover Assembly—L. H.
2	300116	Gasket—Stop Screw—Y-Valve
2	300449	Screw—Muffler to Power Head
2	300474	Nut—Link—Arm to Carburetor
1	301019	Dresser—Breaker Point
2	301069	Ball—Check Valve
1	301071	Seal Ring—Inner
1	301072	Seal Ring—Outer
1	301073	Impeller
1	301074	Nut—Impeller
1	301077	Head—Pump
2	301092	Diaphragm—Pressure Regulator
2	301104	Sleeve—Y-Valve
2	301105	Seal Ring—Outlet—Y-Valve
2	301123	Stuffing—Hand Primer
1	301136	Gasket—Hose Flange to Receiver
1	301145	Key—Impeller
1	301147	Gasket—Receiver to Muffler

QUAN.	PART NUMBER	DESCRIPTION
1	301150	Gasket—Pump Head to Housing
2	301151	Screw—Hose Flange to Receiver
1	301156	Pipe Plug
2	301159	Seal—Pump Housing
14	301161	Washer
2	301163	Gasket—Hose Flange to Y-Valve Body
2	301164	Gasket—Cap to Body—Y-Valve
4	301172	Gasket—Muffler to Elbow
1	301173	Gasket—Elbow to Crankcase
1	301175	Gasket—Y-Valve to Pump Housing
2	301182	Screw—Gage Panel to Rubber Mounting
4	301184	Screw—Hose Flange to Y-Valve Body
1	301195	Screw—Frame Bracket to Pump Housing
2	301200	Screw—Starter Pulley to Flywheel
1	301218	Screw—Frame Bracket to Muffler
3	301219	Screw—Housing to Body
6	301250	Washer—Y-Valve Cap to Body
2	301310	Cup Washer—Hand Primer
2	301311	Nut—Cup Washer
2	301313	Ball—Check Valve—Hand Primer
2	301314	Plug—Check Valve—Hand Primer
2	301315	Gasket—Hand Primer
1	301358	Screw—Screen and Air Horn to Carburetor
1	301359	Box—Tool and Spare Parts Kit
2	301362	Screw—Carburetor to Elbow
1	301417	Block—Impeller Seal Protector
1	375404	Operating Cylinder
1	375443	Puller—Flywheel and Impeller
1	375450	Wrench—Spark Plug